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ABSTRACT

This study examines the costs and operating problems associated with a national center which in response to telephone calls would provide any one of 1000 five or six minute recorded messages; in this case there are envisaged to be on patient-care problems. The phone calls are assumed to arrive via Inward Wide Area Telephone Service (INWATS) lines and the number and costs of such lines are computed. An automatic message selection unit is described. Guidelines for data base development and promotion of the service are also provided. (Author)

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A STUDY ON THE FEASIBILITY OF ESTABLISHING A NATIONAL MEDICAL DIAL ACCESS INFORMATION RETRIEVAL SYSTEM

Thomas C. Meyer

Wisconsin University
Madison, Wisconsin

February 1970

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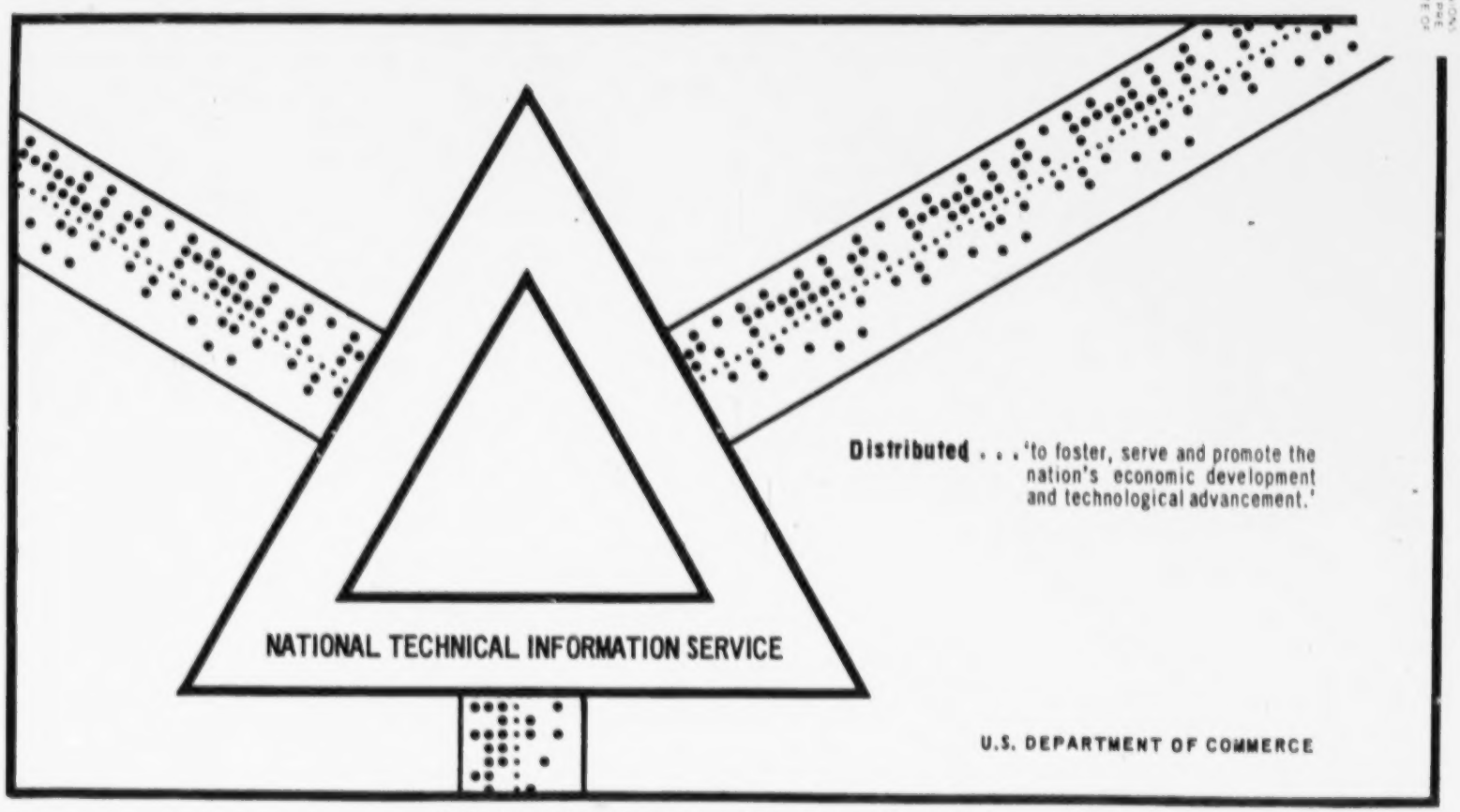
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A STUDY ON THE FEASIBILITY OF ESTABLISHING A NATIONAL MEDICAL DIAL ACCESS INFORMATION RETRIEVAL SYSTEM

Prepared for the Lister Hill National Center for Biomedical Communications

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The Department of Postgraduate Medical Education

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16. Abstracts

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Prepared for the Lister Hill National Center for Biomedical Communications

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The Department of Postgraduate Medical Education

The University of Wisconsin

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Summary of Conclusions

Feasibility

1. It is feasible to establish a national medical dial access information retrieval system (DAIRS).

Communications System

2. The nationwide telephone network provides an appropriate, if not ideal, communications system for a national medical DAIRS.
3. In-WATS telephone service is the most appropriate.
4. Availability in areas not served by In-WATS should be provided after the central resource has been established and stabilized.
5. There are no communications methods under development which have significance for a national medical DAIRS in the near future.

Hardware

6. A technical system providing both automatic and semi-automatic access best meets the present and anticipated needs of a national medical DAIRS.
7. There are no major advances in DAIRS technology considered sufficiently imminent to have a major impact on selection of an appropriate technical system.

Data Base

8. Initial development of the data base should be generally proportional to incidence of disease until sufficient data becomes available to identify informational needs.

9. Specialty societies would most appropriately provide the mechanisms for selection of topics and authors and validation of content.

Promotion

10. The basic promotional method for the resource should be direct mail with a six-month promotional cycle.
11. Supplementary promotion and publicity should be carried out through journal advertising, press releases, columns and feature articles.
12. Promotion should be used as a tool to stabilize utilization.
13. Studies should be conducted on the effect and relative value of the various types of promotion and publicity to refine the long-range promotional program.

Indexing

14. Both a permuted index and subject heading index should be utilized to provide optimum ease of entry into the system, with operator assistance available to those with special problems.

Evaluation

15. The development schedule should be monitored from the start of the project until the system becomes operational.
16. During the first twelve months of operation, data should be gathered on the system of operations to determine whether the system has been established in accordance with planning specifications and whether the operational components are being maintained and improved in terms of the planning objective. Instruments should be designed and tested for future measurement of use of the system and content by physicians and its impact on patient care.
17. During the second twelve months of operation, data should continue to be gathered on the system of operations and data collection should begin in the areas of use of the system and content by physicians and impact on patient care.
18. The third year should be devoted to analysis and application of data gathered in the first two years of operation.

Costs

19. A national medical DAIRS which would meet the optimal service requirements of physicians could be established and operated for one year on a budget of approximately $800,000.
20. A system which would meet minimal service requirements of physicians could be established and operated for one year on a budget of approximately $235,000.

Glossary of Words and Phrases

Certain words or phrases used extensively in this report which are not generally familiar or have taken on unique significance in the context of the report are defined as follows:

Cartridge: An audio tape holder which utilizes one-fourth inch tape, normally is a continuous loop assembly, with the pressure roller and capstan normally enclosed within the holder.

Cassette: An audio tape holder which utilizes 150 mil. tape, normally is reel-to-reel transfer, and functions with the capstan and pressure roller outside the holder.

Core Information: Facts and opinions which form the essence or central part of the knowledge on a specific topic.

Data Base or Data Bank: Information which is stored in and available for retrieval from a dial access system.

Dial Access Information Retrieval System (DAIRS): A system involving remote access via the national telephone communications network to a data bank of pre-recorded audio program units.

Automatic DAIRS: A self-acting system responsive to inputs by the receiver and not requiring manual manipulation at any other point in the process.

Semi-automatic DAIRS: A system requiring an operator other than the receiver to input operational signals.

Manual DAIRS: A system requiring an operator other than the receiver to manipulate the program unit.

Hardware: The equipment necessary to store, transmit, record, and present the information desired in a DAIRS.

Holding Time: The time between the establishment of a telephone connection and the breaking of that connection, e.g. the time a single communications path is in use in the DAIRS.

Interface: The point at which two systems meet or are interconnected, e.g. the interconnection between the telephone communications system and the hardware system.

Inward Wide Area Telephone Service (In-WATS): A special access line to the nationwide telephone network providing for receipt and payment of calls from selected service areas at a specific monthly rate.

Manual Magneto: A telephone instrument which initiates a signal to an operator by hand cranking of a magneto.

Program Unit: A segment of core information indexed and retrievable from the data bank, e.g. one tape recording on a specific topic.

Rotary Dial: A telephone instrument which utilizes a dial instrument to initiate impulses over a communications system.

Standard Metropolitan Statistical Area (SMSA): A geographical area having a central city of 50,000 or more inhabitants,

the remainder of the county occupied by the central city, and contiguous counties that are integrated economically and socially with the county containing the central city.

Touch Tone® : A registered trademark designating a telephone instrument which uses push buttons to transmit varying frequencies or tones over a communications system.

Touch Tone Pad: An auxiliary instrument which can be connected to a rotary dial instrument to use push buttons to transmit varying frequencies or tones over a communications system.

I. Introduction

In the face of rapidly advancing scientific knowledge and increasing health care expectations a number of obstacles face the busy medical practitioner in his efforts to deliver optimal health care. One of these is that he is frequently faced with a problem and has to make a decision when he does not have access to his usual sources of reference, or when his own reference material is outdated. A second obstacle is the shortage of time for the physician's own continuing education in the form he finds most convenient. Finally there is a theoretical possibility that individuals learn best when pertinent information is presented at the time the problem is most pressing.

Development of Concept

Recognizing these obstacles, a pilot project was initiated at the University of Wisconsin in April 1966 to provide prompt, convenient access to authoritative medical information by telephone. Initially 88 tape recordings of 4-7 minutes duration, presenting "core" information on a variety of medical subjects, were made by University of Wisconsin Medical Center faculty members. The tapes were placed in self-rewinding cartridges that could be played in an inexpensive tape repeater coupled to a telephone line. A brochure listing and describing the tapes was distributed to physicians in

the state so that the user simply had to dial the number indicated and ask for a tape which would be played for him within 15-20 seconds. The library was established in the University Hospitals' pharmacy to provide 24-hour service.

The service proved popular and promising enough that it was expanded to almost 300 tapes, a duplicate library was established in the Milwaukee area, and a combination of In-WATS and local exchange lines were put in to provide toll-free service to calling physicians.

A post card survey of physicians using the Wisconsin service between October 1, 1968 and June 30, 1969 (a total of 3,595 calls) provided the following data:

Table I-1 Reason for Call		Percent of Total Calls
1. Called because of specific patient problem		44.8
Physicians reported that tape content:		
Changed one or more items of management	19.7	
Provided new information	36.9	
Provided confidence in managing patient	39.9	
2. Called for general reason or curiosity		47.6
Physicians reported that tape content:		
Changed one or more aspects of their practice	12.8	
Provided ideas for improving patient care	33.2	
Provided review or evaluation of their approach	47.3	
3. Called for both specific patient problem and general reason		7.6

Of the physicians who used the service during this 9-month period, 20.5% indicated their calls were in regard to an immediate or emergency problem.

The data would indicate that such a service has value in both immediate health care delivery and postgraduate medical education, and that it may have changed behavior in nearly one-third of the physicians who used it.

A similar service has been developed at the University of Missouri, utilizing an automated technical system. A hospital in South Bend, Indiana set up a cancer information service for physicians in the community. A number of Regional Medical Programs became interested in the service and both North Dakota and Northlands (Minnesota) have installed lines to the Wisconsin libraries. Iowa has indicated a desire to be similarly linked. Independent libraries have been or are being established under RMP auspices in New Jersey, New Mexico, Utah, Northwest Ohio, Central New York. Libraries are being established under university auspices in Nebraska and Saskatoon, Saskatchewan. The Oklahoma Regional Medical Program is discussing a library to serve one or more states in that area of the country.

The original intent of the developers of the Wisconsin library was to encourage regional expansion of the medical dial access concept. The belief was that this would provide response to local needs, innovation in technology and educational approach, and an exchange of educational materials among libraries. However, this has occurred only to a limited degree. It now appears timely to explore the possibility of a national resource. The National Library of Medicine and the Lister Hill National Center for Biomedical

Communications share this interest and consequently funded a study on the feasibility of establishing a national medical dial access information retrieval system (DAIRS).

Objectives

It is felt that such a national resource should:

1. Provide authoritative "core" information on a broad number of medical subjects related to patient care, with emphasis on the needs of physicians providing family health care.
   a. Give special attention to information required in emergency situations.
   b. Give special attention to providing current information which would enable physicians to update their knowledge in specific areas.
2. Be available when the physician requires the information.
3. Be accessable from any location where there is a telephone.
4. Be of sufficient technical quality to not interfere with the acquisition of the desired information.
5. Be provided at the lowest possible cost consistent with the physician's information and accessibility requirements.

Scope of Study

In an attempt to determine the feasibility and options available in designing a national resource to meet these criteria, the study was designed to explore the following areas:

I. Technology
   A. Communications Systems
      1. Investigate present capabilities of the telephone communications system in the United States and the various options and cost factors pertinent to a national medical DAIRS.
      2. Explore communications methods under development for immediate or future application to a national medical DAIRS.
      3. Ascertain areas, e.g. Alaska, Hawaii and Puerto Rico which may require special consideration.
   B. Hardware
      1. Investigate alternatives in automated and manual systems applicable to the concept, and where possible gather operational and cost data.
      2. Gather information on systems in the developmental stages which may have immediate or future implications for DAIRS.

II. Data Base
   A. Selection of Library Content
      1. Explore various sources to determine the nature of medical practice in the United States as a guide to need for medical information.
      2. Collect available research reports dealing with physician need for medical information.
      3. Suggest criteria for selection of library content.

B. Development of Library Content

1. Explore potential resources.

2. Examine possible relationships between the contributing faculty and the library.

3. Suggest criteria for acquiring, validating, and updating library content.

III. Publicity

A. Promotion

1. Explore direct and indirect methods of promoting the service to potential users.

B. Indexing

1. Investigate possible indexing systems which meet both the technical and promotional requirements of providing immediate, convenient access to library content.

IV. Evaluation

A. Techniques

1. Explore the literature for techniques applicable to evaluation of such a library service.

B. Criteria

1. Suggest criteria for evaluation of a national dial access library.

It has been a major goal of the study to produce a practical report which would offer a conclusion as to whether or

not a national DAIRS is feasible and, if so, to present the options available to an organization interested in establishing such a resource.

Survey of Literature

Limitations in the time and scope of the study made it necessary to design an approach which made maximum use of the current literature, so that staff members could direct their attention to those areas not already covered by competent researchers.

The literature search utilized Education Index, Psychological Abstracts, Sociological Abstracts, and Dissertation Abstracts for the years 1965-1969. The results of this search, utilizing 24 topic headings and 13 key words, are presented in Appendix 1. Using this as a base, individual staff members conducted further informal searches in their specific areas.

Staff composition was intentionally directed to select individuals with skills for seeking out and collecting information rather than those with a depth of knowledge and expertise in a specific area. Therefore, staff contact with individuals throughout the country by letter, telephone, and personal visit played a significant role in the study. No extensive surveys were thought to be necessary and none was attempted.

The literature search proved productive in determining the present "state of the art" in defining those areas in which the study staff could most productively direct their efforts to make determinations unique to a national medical DAIRS. It did not prove particularly

helpful in providing information and data directly applicable to this study.

State of the Art

In summary, the dial access concept, as applied to the teaching-learning process, was initiated at the University of Michigan in 1961. National interest was focused on its use in the language laboratory until 1965 when a number of major universities installed multi-subject systems. Since that time experimentation has been primarily directed to sophistication of study carrel operation and establishment of remote student access points in the adjacent campus and off-campus areas. Stewart[1/] indicates that there were 40 DAIRS installations in operation in the country in March 1965, 110 in February 1966, and about 250 by February 1967. His current estimate of operational DAIRS in the country is more than 450. These installations are located primarily in high schools, colleges, and universities.

Two general studies in the field of DAIRS became available in 1968. One, by Henry M. Grumbling,[2/] was produced to orient the Colorado State College Faculty to dial access systems and to determine whether there was need for such an installation on that campus. The second,

1. Stewart, Donald K., ed., "Updating the D-A-I-R-S Survey", Dial Access Information Retrieval Systems for Education, Newsletter, Special Issue No. 6, Center for the Application of Technology to Education, College Station, Texas, (February, 1967), p. 1.

2. Grumbling, Henry, Dial Access Information Retrieval Systems In Higher Education and Implications for Establishing a System at Colorado State College, Dissertation, University Microfilms, Inc., Ann Arbor, Michigan, 1968.

by Gabriel D. Ofiesh, Ed. D., [3/] provides guidelines for educators on DAIRS. Both Grumbling and Ofiesh attempted to itemize the strengths of DAIRS. From a survey of 87 institutions utilizing dial access systems, Grumbling [4/] lists these strengths in decreasing order, as follows:

1. Individualized instruction, assists independent study.
2. Materials available when students need them.
3. Excellent for review or reinforcement and enrichment.
4. Stimulates teachers to prepare better.
5. Wider range of learning materials available to students.
6. Students learn more and faster.
7. Students do not have contact with recorders and tapes, etc.
8. Increases student motivation toward learning.
9. Releases teachers from repetitive routine duties.
10. Lower cost of instruction.
11. Availability of learning materials at several places.
12. Easier to expand than a conventional library.

Ofiesh [5/] arrives at almost identical conclusions, with the only major areas of disagreement being cost and lack of adequate research to prove instructional effectiveness.

A comparison of these strengths with the goals of a national medical dial access library, as previously set forth, shows

3. Ofiesh, Gabriel D., Dial Access Information Retrieval Systems: Systems: Guidelines Handbook for Educators, Center for Educational Technology, The Catholic University of America, Washington, D.C. 1968.

4. Grumbling, Ibid., p. 153.

5. Ofiesh, Ibid., p. 21-22.

a high degree of compatibility.

At the initiation of the study, then, the staff was faced with:

1. A new educational technology (DAIRS) which has been under development for less than a decade, in applications not directly comparable to the proposed resource.

2. A limited assessment of this new technology which does indicate a high degree of compatibility with the goals of the proposed resource.

3. Very limited experience and data on the specific application of this new technology to retrieval of medical information which indicates promise as an educational resource and which more importantly may bring about change in physician behavior.

II. Technology -

A. Communications System

The national telephone communications network offers a general capacity and capability compatible with the requirements of a national medical DAIRS.

Within the 48 contiguous states, it can be treated as a single system and interconnections are possible with Alaska, Hawaii and Puerto Rico. Inter-company service and tariff agreements make this possible, even though telephone service is provided by two major organizations (The Bell Telephone Company and The General Telephone Company) and a large number of independent companies. The important fact is that a telephone subscriber in any location in the United States can access any other subscriber, regardless of the company providing the service to either individual.

System Capabilities

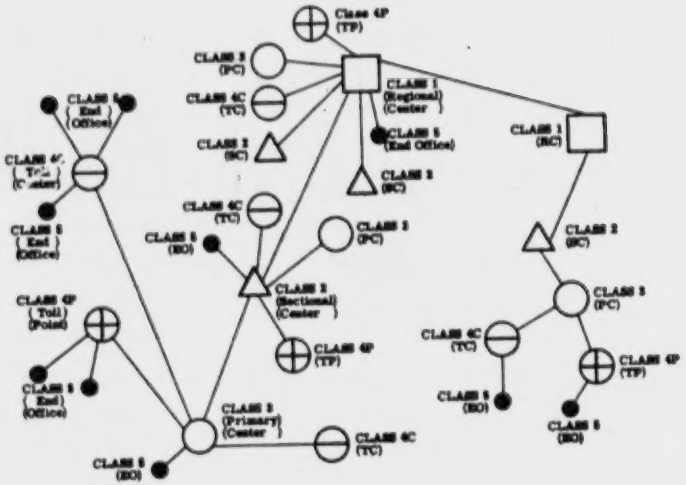
There is a switching plan for the network (Figure II-A-1), which divides the country into 10 regions. Each region has sections, and each section primary areas. The primary areas are further divided into toll centers and toll points, and each of these has a number of end offices. The end offices serve the customer telephones.

It is not necessary for a long distance call to proceed

Figure II-A-1

SWITCHING PLAN

(Basic Principle)



Symbol	Class	Name	Abbreviation
□	1	Regional Center	RC
△	2	Sectional Center	SC
○	3	Primary Center	PC
⊖	4C	Toll Center	TC
⊕	4P	Toll Point	TP
●	5	End Office	EO
—	Final	Trunk Group	

sequentially through this hierarchy; there are many variations based on speed and economy of service. A long distance call will always go to an end office, be routed through the national switching system as appropriate, and go through an end office to the specific number being called.

This national telephone network can be accessed in two ways. Some service is restricted to Operator Distance Dialing where the destination code must be given verbally to an operator so she can enter the network with the information necessary to complete routing of the call. Direct Distance Dialing (DDD) provides for completion of long distance calls within a matter of seconds without any assistance from intermediate operators.

This switching system also provides automatic alternate routing. Normally a long distance call will be routed in the most direct manner. However, if there is no circuit available over this direct route, the system provides for rapid testing of other potential routes and automatically selects the most feasible one available at that time.

A general, but not yet uniform, factor of the national telephone network is the 10-digit destination code. The first three digits indicate the Numbering Plan Area Code (area code), the next three the end office, and the final four digits the station number desired. In this way every telephone subscriber in the country has a unique destination code.

The voice grade circuit of the national telephone communications system (a frequency response of 300-3000 Hz) is adequate for the quality of communications required by the proposed service.

System Limitations

There are, however, some limitations. The most significant deals with non-uniform technology. While this non-uniformity involves the switching equipment as well as the instrument used for accessing the network, it is best illustrated by the fact that certain areas have the manual magneto telephone, others rotary dial, and still others touch tone®.

The limited number of subscribers equipped with manual magneto telephones are restricted to Operator Distance Dialing, and could not have automatic access regardless of the sophistication of the DAIRS equipment.

The majority of instruments are rotary dial, and could process a call automatically to the interface with a DAIRS. However, due to design of the telephone switching system, once a call is completed to the interface, no additional signals can be transmitted by using the dial mechanism.

Touch tone, which utilizes a push button mechanism on the accessing instrument, is most capable of making maximum utilization of DAIRS technology. Not only can it be used for the 10-digit destination code, but also to transmit further data after the connection is established at the DAIRS interface. This could give the caller the ability to select his own program unit within

the library and in certain systems allow him to have direct control over the transmitting unit.

However, touch tone service is not a universal capability of the national telephone communications network, nor will it be in the foreseeable future. For example, if a national medical DAIRS were initiated in 1970, the Bell System would have 50.8% of its main stations (single-party or multiple-party lines) equipped for touch tone, but only 8.3% of its total main stations are expected to subscribe to the service. By 1980 the Bell System expects to have 92% of its main stations equipped for touch tone and General Telephone Company anticipates 80%, but both predict that only 35% of these will subscribe to touch tone service.

Decisions regarding the short-range importance of touch tone capability must take into account two factors. First, physicians could be expected to adopt touch tone at a faster rate than the general population once it becomes available to them. Secondly, a touch tone pad, used in conjunction with a rotary dial instrument, could give the user the same accessing potential as conversion of the national network. It would require use of the rotary dial instrument to interface with the DAIRS, and then use of the pad to transmit additional data.

Summary

In summary, there is a nationwide telephone network available for a national medical DAIRS which would provide access to the data bank from any telephone in the country with a quality

of voice communications adequate for the proposed service. The fact that approximately 11.8 million long distance calls are completed daily over some 200,000 long haul trunks indicates that projected use of a national medical DAIRS is well within the present capacity of the system. The major limitation imposed by the system is non-uniformity of technology for accessing a DAIRS which eliminates fully automatic access for all users as a design option.

Analysis of Requirements

To use this communications network most effectively, the Bell System recommends analysis of need based on seven criteria:

1. Function
2. Distribution
3. Volume
4. Urgency
5. Language
6. Accuracy
7. Cost

1. Function

The function of the system, simply stated, is to provide 4-7 minute informational messages to physicians at any time of the day or night.

2. Distribution

The messages must be accessable to any telephone in the United States from one central source.

3. Volume

Projections of utilization of such a national resource can best be based on the experience of existing medical tape recording libraries. This is determined in Appendix 2 as an average of 1,125

calls per day for a centralized national resource, with a peak period utilization of 107.7 calls per hour. Holding time (the average time to complete one call) is estimated at 6.0 minutes.

4. Urgency

Since some of the calls are expected to be of an emergency nature, the requirement of immediate access to the data bank is a rather rigid one.

It seems impractical to provide sufficient telephone line capacity at the DAIRS to assure that no physician would ever receive a busy signal. However, provision can be made within the technical design to intercept busy signals and provide an appropriate response. For this reason, a level of 5% busy signals is considered acceptable.

5. Language

Voice transmission is expected to be the primary language requirement. In addition, it may be desirable to receive touch tone signals and convert them to whatever form is required by the DAIRS.

6. Accuracy

The requirement is that a verbal message be transmitted to any telephone in the United States with sufficient technical quality to be clearly understandable to the caller. This is particularly important when such information as drug dosage is given. Also, many medical terms sound similar but are not interchangeable, and transmission quality must be sufficiently high to avoid misunderstandings.

7. Cost

The service should be provided at the lowest cost consistent with the physicians' information and accessibility requirements.

Tariff Options

There are a number of options available within the tariff structure of the telephone industry. These include: (a) long distance service on a charge per call basis, (b) private line service, (c) Telpak service, and (4) Wide Area Telephone Service.

Individual Charge Per Call

Long distance service on a charge per call basis is the standard tariff for telephone subscribers. The toll is based on distance between the two points and length of call, with variations for time of day and day of week. This tariff option would present an alternative of either the user or the sponsor of the DAIRS paying the cost, and is one which should be considered since telephone costs will be the major budget factor of a national medical DAIRS.

There are two drawbacks to such a tariff. The first is that the total cost of the service would be greater, regardless of who was paying it. Due to the many variables involved, detailed proof of this in direct relation to distribution of anticipated utilization would be a lengthy and detailed exercise. It is felt that the following will adequately illustrate the point:

Toll charges for a 6 minute station-to-station call to Madison, Wisconsin between 8 p.m. and midnight, the peak utilization period, would be as follows from a selection of geographic locations:

Table II-A-1

Individual Charge Per Call

Location	Cost	Location	Cost
Grand Rapids, Mich.	$1.00	Charlotte, N.C.	$1.30
Indianapolis, Ind.	1.05	Columbia, S. C.	1.30
Des Moines, Iowa	1.05	Atlanta, Ga.	1.30
Columbia, Mo.	1.05	Jackson, Miss.	1.30
Columbus, Ohio	1.25	Washington, D. C.	1.30
Pittsburgh, Pa.	1.25	Baton Rouge, La.	1.30
Charleston, W. Va.	1.25	Rapid City, S. D.	1.30
Bowling Green, Ky.	1.25	Denver, Col.	1.30
Nashville, Tenn.	1.25	Casper, Wyo.	1.30
Little Rock, Ark.	1.25	Bangor, Me.	1.35
Bemidji, Minn.	1.25	Tampa, Fla.	1.35
Grand Forks, N.D.	1.25	San Antonia, Tex.	1.35
North Platte, Neb.	1.25	Roswell, N. M.	1.35
Dodge City, Kan.	1.25	Great Falls, Mont.	1.35
Oklahoma City, Okla.	1.25	Ogden, Utah	1.35
Knoxville, Tenn.	1.25	Phoenix, Ariz.	1.35
New York, N. Y.	1.30	Providence, R. I.	1.35
Trenton, N. J.	1.30	San Francisco, Calif.	1.60
Montpelier, Vt.	1.30	Los Angeles, Calif.	1.60
Boston, Mass.	1.30	Boise, Idaho	1.60
Hartford, Conn.	1.30	Reno, Nev.	1.60
Concord, N. H.	1.30	Salem, Ore.	1.60
Richmond, Va.	1.30	Seattle, Wash.	1.60

The cost per call would be greater than this during the daytime and early evening on weekdays and less during the early morning hours and on weekends. For comparative purposes, a 6 minute call from any geographic location at any time under a different option to be discussed later (In-WATS service) would cost an average of $.72. From the table above, it can be seen that calls from all of the locations listed exceed this amount.

The second drawback to this procedure is that as a national resource it would not be equally available to all users and would impose a penalty on those who are farther away from the resource. If the user were charged, the cost would increase in proportion to the distance from the central resource.

One way to avoid this would be a standard rate for physicians using the DAIRS, an option not now available. Inquiry to the Bell System as to the feasibility of establishing such a rate indicated that this would be a violation of Section 202(A) of the Communications Act of 1934 which prohibits discrimination in charges for any class of persons.

Another method would be to sell a subscription entitling a physician to a specific number of calls per year for a set fee. This could be on a unit cost, regardless of geographic location. The necessity of issuing individual identification numbers and accounting of utilization would present significant administrative difficulties.

Of major importance in considering direct charge to the user either on a charge per call or subscription basis is whether or not this would discourage use of the resource. No reliable data are available, but the Wisconsin library did follow the charge per call principle during its feasibility study period in 1966-67. The rate of calls per day per thousand physicians was approximately 1.00, in comparison with a rate of 3.66 when the charge was paid by the library. However, a high level of curiosity calls during the feasibility study would tend to inflate the first figure while

lack of significant promotion would tend to reduce it. The extent to which these affect the level of utilization is not known, and consequently no valid comparison can be made.

Private Line Service

It is possible to lease telephone service on a single line basis from one point to another and have unlimited use of that line for a flat rate. This is not appropriate for direct access to a DAIRS as proposed, since the originating call could come from any one of the 80 million telephones in the country.

The possibility of having regional calls come to a remote point, e.g. New York City, and then be switched on a private line to the DAIRS site, was investigated. Inquiry revealed that present tariff regulations do not permit such a connection between these two types of service.

Telpak Service

This is a tariff by which a number of lines may be purchased between two points, much as a single private line described above. Again, this is designed mainly for point to point service and is inappropriate for the general requirements of a national DAIRS. Interconnection of WATS and Telpak services is not allowed under present tariff regulations and would prohibit regional collection of calls as proposed above.

Wide Area Telephone Service

Another tariff alternative is Inward Wide Area Telephone Service (In-WATS). Under this arrangement customers are provided with access lines to the national telephone network. There is no charge for an individual call. Rather, one may select full-time service (24 hours a day) or a measured time service (10 hours of calling time per month with additional use charged by the hour).

For cost purposes, the 48 contiguous states are divided into six service areas, extending outward from the state in which the service is purchased. The widest service area (Area 6) covers 47 states, omitting the home state, Alaska, and Hawaii. Similar service can be purchased for the home state, but not for Alaska or Hawaii.

Assuming In-WATS to be a logical service for a national medical DAIRS, there are a number of options under which it could be purchased. For example, Figure II-A-2 shows the six zones for service purchased with Wisconsin as the home state; this would vary if another home state were selected.

In examining the options, it is important to consider that in purchasing a service area with a higher number designation all states in lesser numbered areas are included in the service. Thus the simplest configuration would be to purchase sufficient zone 6 lines to meet the anticipated peak level of calls. The most complex would be to compute the anticipated level of calls from each zone

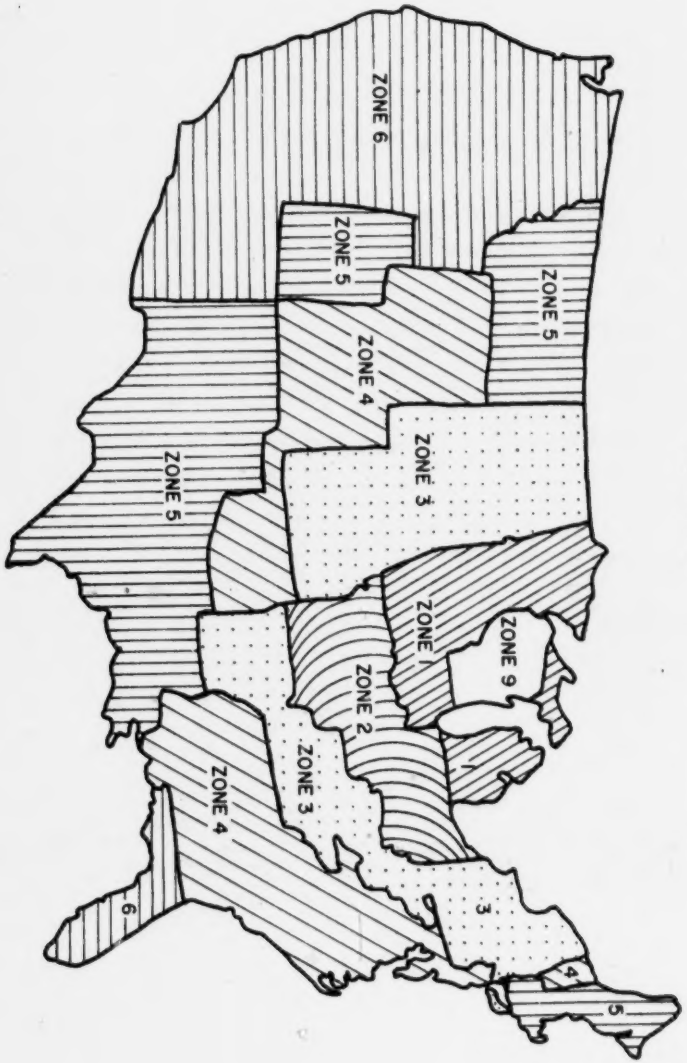


Figure II-A-2

and purchase the appropriate number of full time and measured time lines to meet the anticipated requirements from each zone.

Selection is further complicated by the fact that the cost varies by zone, and the rate for similarly numbered zones will also vary depending on which home state is selected as the base of the service.

For example, the monthly rates for a service with Wisconsin and New Jersey as the home states are as follows:

	Full Time		Measured Time	
	Wis.	N.J.	Wis.	N.J.
Zone 1	$700	$500	$180	$130
Zone 2	1,100	700	240	180
Zone 3	1,300	1,300	260	260
Zone 4	1,500	1,700	280	300
Zone 5	1,600	1,950	290	335
Zone 6	1,950	2,275	335	375

Since there are so many options involving both zone selection and combinations of full time and measured time lines, the computations are best handled by a computer. The National Library of Medicine has provided the results of a computer analysis from a separate report by The Rand Corporation.[1/] The following configuration is the most economical in view of the projected level and distribution of utilization of a resource with Wisconsin as the home state:

1. Dei Rossi, J.A.; Mills, G.F.; Sumner, G.C., A Telephone Access Biomedical Information Center, Rand Report RM-6204-NLM.

In-WATS Line Requirements

Zone	Requirement
3	6 full time lines 4 measured time lines
6	6 full time lines 4 measured time lines
9 (Wisconsin)	1 full time line 1 measured time line

While these projections are the result of detailed and extensive computations, it must be pointed out that they are based on limited data from three existing libraries in a Midwestern setting. This limitation of the initial data will make it necessary to closely monitor actual utilization at such time as a national medical DAIRS is established and adjust the level of telephone service to achieve maximum economy.

Alaska, Hawaii and Puerto Rico

At the present time there is no In-WATS service available to Alaska, Hawaii, or Puerto Rico, nor are there any long-range plans for extending this service to these areas. In addition these areas do not have the capability to make DDD calls to the other 48 states.

Three options are possible:

1. Do not include these areas in initial planning of a national medical DAIRS.

2. Make provision for physicians in these areas to access the central library.

3. Establish local libraries in these locations.

Directing calls to a central library, while feasible, would be expensive. The projection, on the basis of a 6-minute holding time, is as follows:

Table II-A-2

	Calls Per Year	Cost Per Call	Annual Cost
Alaska	183	$12.60	$2,305.80
Hawaii	1,789	$10.90	$19,500.00
Puerto Rico	3,030	$10.80	$32,724.00

Perhaps the best approach would be to exclude these three areas from initial planning, and once a service is established for the 48 contiguous states, explore the possibility of establishing a 24-hour-a-day service for these areas within the structure of an existing medical facility. The cost of full-time staffing would prove prohibitive, but the Wisconsin libraries have operated by providing partial salary support to employees at the two library locations to the satisfaction of both the developers of the service and those operating the libraries. Service to Alaska would depend on development of less expensive communication methods or on a decision to assume the annual cost involved for the toll calls.

Communications Methods Under Development

Because of the short term of the study, it was necessary

that the staff investigate developmental projects in the communication field on a broad basis, and not pursue those which did not appear to affect decisions involved in the study. This approach resulted in virtually ruling out any major developments for short range consideration, i.e. in the next 5 years.

While the telephone communications industry maintains an active research and development capability, it appears that major effort and commitment of capital is being directed to consolidation of past advances, i.e. upgrading the national communications system to touch tone and meeting the expanding residential and business needs of the country.

The next major capability to be offered will probably be Picturephone. While the capability can be demonstrated and is in experimental use between points in New York City and Pittsburgh, Pennsylvania, the general availability is not sufficiently imminent to make it a significant factor in present planning. Laser transmission is also the subject of research, but again has no immediate significance. Experimentation and planning of satellite communications is well advanced, but again there are no indications of application on an operational scale in the immediate future.

Conclusions

1. The nationwide telephone network provides an appropriate, if not ideal, communications system for a national medical dial access information retrieval system.

The major constraint placed on a random, remote access system is due to non-uniformity of technology. For this reason, any technical system utilized must be designed to meet the various levels of capability, or be restricted to a manual operation.

2. In-WATS telephone service is most appropriate.

Of the various tariffs available only a charge per call, paid by the user, or an In-WATS service appear feasible. Financing of telephone costs by the user involves inequities and may well discourage use of the resource. In-WATS service, while resulting in a substantial budgetary amount, would place the resource in its proper context - an information retrieval service available to the physician, with subsequent benefits to the patient, without economic factors affecting its utilization.

3. Availability in areas not served by In-WATS should be provided after the continental resource has been established and stabilized.

The cost of serving physicians in Alaska, Hawaii, and Puerto Rico from a library located in the contiguous 48 states is substantial. Establishment of manual libraries in Hawaii and Puerto Rico appears feasible, but service for Alaska physicians will require acceptance of the high unit cost or development of other communications options not now available.

4. There are no communications methods under development which have significance for a national medical DAIRS in the near future.

Picturephone, laser transmission, satellite communications, etc., while all the subject of research and development, are not sufficiently advanced to have a major bearing on decisions and recommendations involved in this study.

II. Technology -

B. Hardware

The purpose of this section of the report is to present information on technical systems now available or in developmental stages which would be appropriate to a proposed national medical DAIRS, and to compare manual and automated systems.

Strategy

The literature search references and independent inquiry revealed that there are a number of manufacturers providing systems or components with varying specifications and capabilities. Strategy used was: (1) to compile a list of manufacturers or distributors with established reputations in the field, (2) contact them for product information, and (3) plan visits to selected installations which they felt best demonstrated application of their systems or components. Site visits were desirable since they provide certain operational data not otherwise available.

Only general parameters of the proposed technical system were presented to the manufacturers. Rigid technical specifications were not set since this might eliminate a potentially suitable system for a minor reason.

The general parameters set for the system are as follows:

1. Program length - 4-7 minutes

2. Program units - 1,000 with capability for future expansion.
3. Access time - program starts within 30 seconds of the time the call is received.
4. Random access - any incoming call that reaches the interface has access to any program unit from the start of the program.
5. Interface - capable of interface with the national telephone system with 20 incoming lines and capability for future expansion.

A total of 25 manufacturers and suppliers was contacted in the initial effort to obtain equipment descriptions and specifications. These initial inquiries and the literature search revealed that available and developmental technical systems present the following options:

1. Message source:
    a. Audio tape
        1. Reel-to-reel
        2. Cartridge
        3. Cassette
        4. Loop bin
    b. Audio drum
    c. Magnetic disc
2. Switching:
    a. Mechanical
        1. Crossbar-relay

2. Rotary relay
3. Code bar
4. Reed relay
5. Stroger switch

b. Solid State

1. Computer core
2. Transistor Matrix

3. Control Unit

a. Computer

b. Console

There are other components which may or may not be required depending on the system selected. These include playback and program amplifiers, monitoring and test equipment, counters, equipment to translate Touch Tone signals, etc. These latter hardware decisions and options will be based on the major units selected and are not central to decision making.

In investigating the various equipment available the staff encountered a problem in terminology. The terms "automatic" and "manual" were sufficient in looking at equipment capabilities, but became restrictive when considering equipment application to the subject of the study. The fact that Rotary Dial telephones of the national telephone system are unable to control a DAIRS switching mechanism to select a tape, as can be done by Touch Tone, places constraints upon any fully automatic system. Only 8.6% of

the telephones in the Bell System, for example, are now Touch Tone (see section II, page 15). This is all that could presently be served by a fully automated system.

It became obvious, however, that there are degrees of automation which would be desirable, and that there is merit in viewing hardware in terms of its compatability and flexibility within the varying capabilities of the national telephone network.

For this reason, the following definitions were adopted:-

automatic - a self-acting system not requiring manual manipulation at any point of the process.

semi-automatic - a system requiring library staff to input operational signals.

manual - a system requiring library staff to manipulate the program unit.

The inquiries to manufacturers and suppliers resulted in additional problems. The state of the art has caused concentration of research and development on the type of system which provides access to a data bank from study carrels and other fixed locations. Certain capabilities of these systems are inappropriate to the subject of this study and limitations which are acceptable in these systems are serious shortcomings in view of the anticipated requirements. The changes and modifications necessary can be complex.

Also, manufacturers have not seen a broad market in the proposed application and consequently there is little research

Table II-B-1

	Instructo-matic - Merchant	Ampex	Telenorm	North - RCA	Rheem - Caliphone	Ranger	Cousino
Location Observed	Terrant Co.(Texas) College	Factory	Wayne State University	Oral Roberts University	Platteville, Wisconsin H. S.	Univ. of Missouri	Univ. of Wisconsin
Message Source							
a. Master medium	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape
b. Machine configuration	Reel-to-reel	Loop bin	Reel-to-reel	Reel-to-reel	Reel-to-reel	Cartridge	Cartridge
c. Tape width (inches)	1/4	1	1/4	1/4	1/4	1/4	1/4
d. Buffer medium		Magnetic tape					
e. Buffer tape width		1/2					
f. Transfer time		16 Seconds					
Switching							
a. Method	Mechanical	Solid State & Mechanical	Mechanical	Mechanical	Solid State	Mechanical	
b. Type	Stromberg-Carlson X-Y	Solid State & Cross Bar	Reed Relay	Cross Bar	LCR Matrix	Stroger Switch	
Control Unit		General Purpose Digital Computer	Special Purpose Computer	Special Purpose Computer	SCR Shift Register		

and development in progress that has direct application. Research staffs have ideas and enthusiasm, but it appears unlikely that resources will be directed to this application unless some type of support is provided.

Because of these two problems, it is virtually impossible to arrive at meaningful cost estimates for systems revealed or investigated in the course of the study. The cost of modifications and additions of equipment to existing data bank - study carrel systems is difficult to predict. Cost estimates are not possible where the prototype has not been built or tested.

With these limitations the most productive avenue of investigation was to concentrate on those technical systems now on the market, or soon to be available. Developmental systems were not studied in detail if it appeared there were major deficiencies which would require additional research. The matter of cost, while important, was subordinated to the basic requirement of a reliable technical system which would meet the needs of the proposed national medical DAIRS and not jeopardize the entire project because of attractive but untested features.

Following the initial contact with manufacturers and their representatives, discussions resulted in six site visits. The information gathered on these systems is presented in Table II-B-1, and the following discussion is based on these systems. Absence of a specific manufacturer's product does not necessarily indicate that it was considered unsuitable, but rather that it was similar

in all but minor respects to one of the systems observed or required additional features that were untested or required further research.

Mode of Operation

1. Automatic

Only two of the systems observed could provide automatic service over the national telephone network without modification or addition of equipment. These are: (1) the University of Missouri system which can accept either Touch Tone or Dial inputs since a separate telephone line is provided for each program unit, and (2) the Ampex system which has been modified in design to accept Touch Tone inputs and give the caller complete control over the program unit.

All others were designed for access from a study carrel or similar station and would require varying amounts of modification or additional equipment to interface with the national telephone system.

2. Semi-Automatic

Addition of an operator's station to receive calls from rotary dial telephones, that could not be processed on an automatic basis, would be necessary to provide semi-automatic operation.

3. Manual

The only manual system observed, at Wisconsin, couples a tape repeater directly to each incoming telephone line, and while it utilizes the Cousino repeater, any playback machine with program units that can be conveniently handled could be used in a similar manner.

Message Source

1. Magnetic Tape

Magnetic tape was used for storage of all master program units and for the buffer unit in the Ampex system. Tape is reliable, economical and readily available. All systems except the Ampex use one quarter inch tape; the Ampex system uses one inch tape on the master unit and half inch tape on the buffers. Some equipment manufacturers are investigating the use of 150 mil. tape in cassette form, but there were no operational applications at the time of the survey.

Reel-to-reel tape decks are the most popular form of tape transport. All of the decks observed performed adequately. The major problem in the ordinary reel-to-reel tape deck is the total commitment of that program to the first caller, with the second caller joining in progress, receiving a busy signal, or being transferred to another deck with the same content. Solution of this problem by program redundancy significantly increases the size and cost of the system. Other problems identified are slow acceleration to operating speed and improper cueing of program starting points.

There were variations of from one to four tracks on a tape. There were no records of channel cross-talk that could be attributed to the indexing of the head on the tape. Use of more than one track multiplies the availability problem by making all program units on that tape unavailable to other callers when one is in use.

Cartridge and cassette units have found limited application in DAIRS to date, but offer certain advantages, especially in space utilization, and can be expected to increase in popularity. There are a variety of reliable machines on the market which could be integrated into existing DAIRS technology, but the only two systems observed using cartridges were those at Missouri and Wisconsin. A cartridge utilizes one-fourth inch tape, normally is a continuous loop assembly but can be any concept, and the pressure roller and capstan normally fit inside the device. A cassette utilizes 150 mil. tape, is normally reel-to-reel transfer, and is placed over the capstan with the pressure roller pressing against the tape from outside the device. One unit, new on the market, manufactured by Qatron Corporation, provides 12 eight-track cartridges in a carousel arrangement for automatic selection; this was not observed in operation. Another unit proposed by Technitrend, Inc. involved cylindrical units containing 255 tape cassettes, but it was not possible to observe this unit either.

Only one audio drum system was revealed by the study. The unit is manufactured by Metrolab, Inc. and is utilized by Index Division of Reeves Telecom Corporation in the "Realatron" service in Detroit, Michigan. This is a voice response system and at the present stage of technological development has a storage capacity of only 256 words or phrases and is not considered appropriate to present need.

No system was found which utilized the magnetic disc, although this was proposed by some as a possible method of program unit storage. One consultant indicated that with present technology it would take an estimated 30-40 disc sides to store a data base of 1,000 4-7 minute program units, and consequently would be inappropriate for the proposed use.

Switching

The variety of switching units observed performed their function reliably, and the only problems observed were due to total system design and could not be attributed to the switching unit.

Mechanical switching units take more time to complete an operation, than do solid state units, but their speed of operation is entirely satisfactory for the proposed application. They are considered more reliable than solid state units and malfunctions are generally easier to diagnose than with solid state units. Mechanical units generally require more power and space and develop more heat than solid state units.

Control Unit

A DAIRS may or may not require a separate device to control its switching functions. Four of the seven systems observed did. This can be a form of: (1) computer providing automatic control, or (2) a console operated by an individual, or (3) both.

Three of the systems observed used a computer to provide automatic access; the fourth used a Silicone Controlled Rectifier

Shift Register operated from a console to control use of tapes in the language laboratory.

Advantages of a computer controlled system are that it can: (1) provide faster service, (2) handle a greater complexity of switching arrangements, (3) meet increasing Touch Tone capabilities of the telephone communications without further modification, and (4) can provide auxiliary functions such as collection of data on system utilization. In some technical systems it is vital to the operation, but in others is optional.

A console controlled system offers: (1) greater flexibility in meeting individual requests since it involves an operator who can react to a user's directions, and (2) greater convenience in gathering utilization data.

The combination of computer and console control offers: (1) all of the advantages listed above, and (2) a flexibility in that each call can be served in the most expeditious manner, e.g., a user with Touch Tone could access the data bank in a fully automatic manner unless he had a problem, in which case he could access the console operator.

Equipment Under Development

The discussion to this point has considered equipment available and appropriate, with modification in some instances, for establishment of a national medical DAIRS. It does not appear there are any major advances imminent which would affect the recommendations

to be made in this study. Those which can be anticipated are:

1. Improvement of currently appropriate systems.

Equipment manufacturers are apparently directing their attention to further sophistication of study carrels and improvement of message sources. The first has no significance to this study. The second has interest, but shows no promise of changing the advantages and disadvantages on which present decisions are being made. For example, there is much interest in integrating cartridge or cassette units into systems now using reel-to-reel transport, but this will not change the major drawback involving unavailability of program units after the first caller.

2. Improvement of currently inappropriate systems.

There is a possibility that research in voice response units will increase the storage capacity to the point that it would be economically feasible to use such a system for a national medical DAIRS. The major loss in ruling out such systems at the present time is virtual elimination of any future ability to interact with the user. Since this development is so indefinite, it appears that it is a risk to be accepted if a national medical DAIRS is to be established in the near future.

3. Development of completely new systems.

There is always the chance that serendipity will play a part in technological advances. For example, Westinghouse

Learning Corporation in developing its current Integrated Media concept may well devise a system appropriate to current needs. While its approach is on a broad social, cultural and educational basis, with hardware secondary to content and educational methodology, it appears that there will be a requirement for a system similar in requirements to that needed for a national medical DAIRS. If this is the case, it might present a completely new hardware option, but the specifics are not available at this time.

Comparison of Modes

In considering these equipment possibilities in the context of a national medical DAIRS, it may be well to examine the advantages and disadvantages inherent in the general modes of operation:

Automatic System

In an automatic system, the caller is able to gain access to the specific program unit he desires without the assistance of an operator. As indicated, this is currently possible only from those telephones equipped with Touch Tone or a Touch Tone pad, unless a separate telephone line is dedicated to each program unit. Depending on the degree of sophistication desired, provision can also be made for the user, through his Touch Tone instrument, to control the tape, including the ability to stop, rewind, and start forward again.

Advantages

1. Speed of operation.
2. Makes full use of the highest capabilities of the national communications system.

3. Design features offer greatest flexibility in development of additional applications.
4. Minimal operational staff costs.

Disadvantages

1. Can have total system failure.
2. High hardware investment.
3. Higher maintenance costs.
4. More technical staff required.
5. No convenient way of handling queuing.
6. More complicated access procedure for physician making full use of automated features.

Semi-Automatic System

The semi-automatic system differs from the automatic in that the incoming call would be directed to an operator who could then complete the connection through a console to the appropriate program unit. It would differ from the manual system in that the operator would not have to physically handle the tape, cartridge or cassette.

Advantages

1. Personal service feature.
2. Easier and faster operation than manual system.
3. Queuing problems can be conveniently handled.

4. Lower operational staff costs than manual system.
5. Ease of gathering evaluation data.

Disadvantages

1. Can have total system failure.
2. Slower operation than automatic system.
3. Higher maintenance costs than manual system.
4. Higher hardware investment than manual system.
5. Greater space requirements than manual system.
6. Higher technical staff requirement than manual system.

Manual System

In a manual system, it is envisioned that there would be one playback machine connected to each incoming telephone line and a library of individual cartridges or cassettes for each machine or limited group of machines. It would require an operator to receive the incoming call, select the program unit, place it in the playback machine, and start the recording. The operator would be free to serve other callers on other lines until completion of the program. At that time she would remove the program unit from the machine and replace it in the library file to await the next call on that line.

Advantages

1. Lower hardware investment.
2. Personal service feature.
3. Total system failure unlikely.
4. Low maintenance costs.
5. Fewer technical staff required.
6. Queuing problems can be conveniently handled.
7. Relative ease of replacement or updating of programs.
8. Ease of gathering evaluation data.

Disadvantages

1. High operational staff costs.
2. Limited design features would restrict development of additional applications.
3. Slower and more difficult operation.

Discussion of Options

After examining the equipment appropriate and available and the advantages and disadvantages of various systems and mode of operations, it appears that the logical options are:

1. A manual system with a playback machine serving each incoming telephone line.
2. A system capable of both automatic and semi-automatic operation.

1. Manual System

The advantages are: (1) significantly lower hardware investment and (2) total system failure is unlikely. Other advantages such as lower maintenance costs and fewer technical staff tend to be offset by such items as higher operational staff costs.

The major disadvantage is the limitation it imposes on future development. If such a technical system were selected the physician with Touch Tone would access the system in the same manner as those with manual magneto and rotary dial telephones. As the Touch Tone capability grows, the system would be unable to respond. It would also limit the flexibility to respond to changing or newly identified education needs which could be met by a DAIRS.

There is a variety of cartridge and cassette playback units on the market which would be appropriate to a manual system.

2. Automatic and Semi-Automatic System

The advantages of an automatic system with a console unit to permit semi-automatic operation are: (1) full use of the highest capabilities of the national telephone network with the capability of meeting increasing Touch Tone service requirements without modification, and (2) flexibility in meeting changing or newly identified educational needs of physicians.

The major disadvantages are high initial hardware cost and the possibility of total system failure.

At the present state of the art, there are a variety of configurations possible, with the major decisions involving the appropriate message source unit and whether or not computer control is desired or necessary. The study staff has concluded that there is one available system, manufactured by Ampex, which meets the major requirements without modification. It considers this system superior to those designed for study carrel access to a data bank for the particular application involved in this study. While the audio response systems are attractive, it is the opinion of the study staff that the two technologies will probably undergo separate development for some time to come with audio response systems devoted to interactive programming and the type of system involving pre-recorded program units devoted to a more traditional definition of information retrieval.

Conclusions

1. That a technical system providing both automatic and semi-automatic access best meets the present and anticipated needs of a national medical DAIRS.

While a manual system would be acceptable for the immediate application proposed, it would not make maximum use of present telephone capabilities and would result in a relatively static resource. It would be the recommended system only if cost were the determining factor in whether or not such a resource is established.

If a national medical DAIRS is considered to be a resource with present application and potential as a dynamic and growing part

of a national biomedical communications network, it is felt a substantial hardware investment is warranted to provide a high level of immediate service and a future flexibility to meet physicians' changing educational and informational requirements.

2. There are no major advances in DAIRS technology considered sufficiently imminent to have a major impact on selection of an appropriate technical system.

Research and development efforts directed at the identified needs of a national medical DAIRS are sufficiently restricted that no major advances are anticipated in the near future. One of the most promising approaches, the audio response system, is felt to be most appropriate to a different type of informational requirement than that being considered here, and is expected to develop as a separate technology for some time to come.

III. Data Base

A. Selection of Library Content and Faculty

The question of topics which should be included in a national informational resource for physicians is complicated by the broad goals of the library and lack of appropriate data or rationale with which to arrive at decisions. The appropriate number of tapes that could or should be included in the resource is similarly open to a multiplicity of factors and variables which invalidate even general conclusions.

Number of Tapes

The five-year goal of 1,000 tapes is an arbitrary one inserted mainly for budgetary purposes. Determination of specific topics which should be covered in this 1,000 tape resource proves almost equally arbitrary, but it is possible to arrive at general guidelines.

Ultimately, decisions on the total number of topics to be covered and selection of specific tape topics would have to be on the basis of experience over an extended period of actual operation of such a resource.

Selection of Topics

Three options present themselves in determining guidelines for selection of topics: (1) Data which reflects a physician's need for information. (2) That which reflects a physician's want

for information, and (3) Data on incidence of disease, perhaps the most limited of all.

Search of the literature led to several interesting conclusions:

1. Data identifying information need is virtually non-existent.

2. Data identifying want is sparse and presented in a form that is difficult to interpret in terms of the goals of a national medical DAIRS.

3. There is abundant data on the incidence of disease.

For comparative purposes the available data has been converted to a common base, the International Classification of Diseases, Adapted. (ICDA). Of the 19 sources of data obtained, ten were discarded because such conversion was not possible. A comparison of the remaining nine sources is presented in Appendix 3 and a summary of the data is as follows:

Table III-1

Incidence of Disease or Indication of Educational Want and Need

ICDA Category	Median %	Range %
1. Infective & Parasitic Diseases	2.5	0 - 5.8
2. Neoplasms	2.7	0 - 8.4
3. Allergic, Endocrine System, Metabolic & Nutritional Diseases	4.2	2.4 - 20.9
4. Diseases of Blood & Blood-forming Organs	1.8	0 - 4.5
5. Mental, Psychoneurotic & Personality Disorders	5.2	.4 - 9.9
6. Diseases of the Nervous System & Sense Organs	6.3	4.1 - 14.0

(cont'd)

ICDA Category	Median %	Range %
7. Diseases of the Circulatory System	11.0	7.1 - 24.0
8. Diseases of the Respiratory System	12.0	4.5 - 29.0
9. Diseases of the Digestive System	5.6	4.1 - 16.0
10. Diseases of the Genitourinary System	5.2	1.4 - 11.0
11. Deliveries & Complications of Pregnancy, Childbirth & Puerperium	2.1	0 - 8.3
12. Diseases of the Skin & Cellular Tissue	3.5	1.6 - 6.0
13. Diseases of the Bones & Organs of Movement	4.3	2.2 - 6.7
14. Congenital Malformations	.3	0 - 1.2
15. Certain Diseases of Early Infancy	.1	0 - 3.5
16. Symptoms, Senility & Ill-defined Conditions	4.1	0 - 5.9
17. Injuries & Adverse Effects of Chemical & Other External Causes	9.8	0 - 12.4
18. Special Conditions & Examinations Without Sickness	4.9	0 - 20.0
Total	85.6	

The data presented in Appendix 3 and consequently in this summary (Table III-1), can be used only to arrive at generalizations in terms of a national medical DAIRS. One study deals with hospital patients, another with office patients, a third with a limited number

of medical practices in a restricted grographic area, etc. In spite of this heterogenous nature of the data, however, Table III-1 does give guidance for initial development of a data bank. From this a suggestion may be derived as to the appropriate number of program units in each disease category. Since the median percentages in Table III-2 equal only 85.6 per cent, they must be adjusted to equal 100 per cent before the appropriate number of program units in a 1,000 unit library can be computed for the specific categories of disease.

Table III-1

Number of Program Units

ICDA Category	Median %	Adjusted %	Proposed Number of Program Units (1,000 Total)
1.	2.5	2.9	29
2.	2.7	3.2	32
3.	4.2	4.9	49
4.	1.8	2.1	21
5.	5.2	6.1	61
6.	6.3	7.4	74
7.	11.0	12.9	129
8.	12.0	14.0	140
9.	5.6	6.5	65
10.	5.2	6.1	61
11.	2.1	2.5	25

(cont'd)

ICDA	Median %	Adjusted %	Proposed Number of Program Units (1,000 Total)
12.	3.5	4.1	41
13.	4.3	5.0	50
14.	0.3	0.4	4
15.	0.1	0.1	1
16.	4.1	4.8	48
17.	9.8	11.4	114
18.	4.9	5.7	57
Total:	85.6	100.1	1,001

Within this general framework, then, a method could be devised to select the specific topics on which tapes should be made. Once again the data is of little assistance. Only the Wisconsin, Minnesota and North Dakota data indicates in any way the physician's need for information and this is restricted by the fact that only 44.8% of those using the service had a specific patient problem. Their choice of topics was restricted to those tapes currently available. The National Disease and Therapeutic Index is probably the most reliable data source on incidence of disease, but the fact that a physician encounters a certain disease entity more often than another is no indication he has need for information concerning diagnosis or treatment of it.

Lacking data, the next most attractive alternative appears to be to seek informed opinion, either from practicing physicians or medical school faculty. On the basis that those utilizing the service

would be able to render judgments most responsive to their own needs, an informal survey was conducted of the major specialty societies in the country. Their executive directors were asked whether they felt their organizations would be willing to establish mechanisms to recommend tape topics and authors if such a national resource were established. The results of the survey are as follows:

Number Contacted - 15
Yes - 10
No - 2
No Reply - 3

Of the 12 who replied, 10 felt their organization would perform this function. This is an option open to the developers of a national tape library.

Use of medical school faculty in selection of topics would also have specific advantages. They would be particularly well qualified to fulfill the requirement for current information on the diagnosis or treatment of a specific disease or condition. Their in-depth knowledge of the specialty area would enable them to make informed decisions on what tapes might be most appropriate for practicing physicians. There are, however, disadvantages in that medical school faculties do tend to become preoccupied with research that may have little immediate practical application.

The number of program units already in existence in existing medical DAIRS services around the country should not be overlooked in initial development of the data base. Their use would, of course, depend on the willingness of the directors of these libraries and the individual authors to make them available

to a national resource. If a national medical DAIRS is established, it may be expeditious to begin the service with as many of these program units as can be collected. It is felt that they should then be subjected to whatever validation process is established to provide uniformity in the national data bank.

Selection of authors of tapes does not appear to present as great a problem as other portions of the study. If authors were selected only from medical school faculties, the following table indicates that there are a number of qualified individuals nationally:

Table III-3

Filled Faculty Positions In Medical Schools[1/]

Department	Faculty
Anesthesiology	662
Dermatology	173
Medicine	3,687
Neurology	514
Ob-Gyn	752
Ophthalmology	312
Orthopedics	224
Otolaryngology	322
Pediatrics	1,773
Physical Medicine	428
Psychiatry	2,319
Public Health	1,010
Radiology	1,194
Surgery	1,774
Urology	159
Other	132
Total	15,435

In addition, a significant number of physicians in private practice are well qualified to prepare program units for the proposed

1. "Medical Education in the United States", Journal of the American Medical Association, 206:9, (November 25, 1968), p. 2009.

resource.

Legal Liability

The legal liability of a physician who prepares a program unit for a national resource is important. It was the opinion of the University of Wisconsin Office of Legal Affairs that:

> "We have found no case law that would indicate that there would be any legal liability for the individual contributors and/or the institution providing a medical dial access tape library service. It seems quite clear that this would be treated like any other reference source for physicians (i.e. journal articles or scientific lectures) rather than a fee consultation.
>
> "The system you propose of having tape content reviewed by colleagues in some manner sounds good from a professional standards standpoint. However, even with such a review, it would remain a gratuitous sharing of available information from which no implied warranty could be established."

III. Data Base

B. Validation of Library Content

A recurring theme in the literature dealing with DAIRS, which is further emphasized in communication with those responsible for operating dial access systems, is that the most important - yet most often neglected - function is provision of a high quality data bank.

The survey of specialty society executive officers also asked if they felt their organizations would be willing to establish a mechanism for review of scripts as to the validity and acceptability of educational content. The results were as follows:

Number Contacted	- 15
Yes	- 10
No	- 2
No Reply	- 3

While this does not represent a commitment on the part of the specialty societies to provide such a review mechanism, it does indicate that such an arrangement is feasible.

Another option is to establish independent review panels in each of the subject areas of the library to provide validation in much the same manner as that used by medical journals to establish the acceptability of articles prior to publication.

Whatever the method used, a national informational resource requires: (1) A review mechanism before any program unit is entered into the data bank. (2) An evaluation mechanism

to ensure that the program does in fact provide information of value to the practicing physician. (3) A mechanism for revision and updating of information as necessary, and a procedure for discarding programs which do not meet the needs of those who use the library service.

III. Data Base

C. Procedures

On the basis of the foregoing discussion, it is felt acquisition of the data base should involve: (1) Collection of recordings from present medical tape libraries. (2) Development of new topics with the advice of specialty medical societies. (3) When the library has been in operation for a time, users of the resource could also be invited to submit suggested topics for consideration. (4) Selection of new topics should generally follow the guidelines provided by incidence of disease in the ICDA categories. (5) Authors would be suggested by specialty societies and asked to provide a written script and scripts would have to be developed for existing tape recordings. An author's honorarium of $100 would be appropriate but not essential for development of a new program unit, and $25 for updating of a unit. (6) The specialty societies would be asked to provide the mechanism for validation of content. Review by a minimum of three persons is suggested until experience indicates a change would be appropriate. It must be noted that the survey of these societies was on an informal basis, and their participation in acquisition and validation of the data base would depend on official approval of their governing boards. These societies should receive appropriate recognition for their services to the library, but an honorarium to individual members who review

scripts would not be required. (7) Any program unit, whether acquired from an existing library or originally produced, should be validated. (8) Each tape should be reviewed annually and updated if necessary. The detailed procedure would be as follows:

Acquisition:

1. Recommendation of topic add author from a specialty society, or acquisition from an existing library.

2. Contact with the author to obtain a commitment and script for program units to be originally produced.

Validation:

1. Submission of script to specialty society review body.

2. Return of script to author for changes if deemed necessary by the review body.

3. Second review of script if changes have been required.

Production:

1. Recording of program unit by professional announcer.

2. Placement of program unit in data bank.

Review:

1. Twelve months later, analysis of utilization and evaluation data on the program unit to decide if it should be retained in data bank.

2. If so, send script, utilization data and evaluation data to author for review and updating of content if necessary.

3. Send script, whether changed by author or not, along with utilization and evaluation data, to specialty society for validation of content.

4. Re-record program unit if necessary.

This process is expected to be time consuming. Comments from authors of program units for the Wisconsin library indicate that a 4-7 minute presentation is often more difficult to develop than a 30-minute lecture since it must be more precise and anticipate the practitioner's questions. The fact that each script is only about three double-spaced typed sheets eases the validation process. However, since the procedure will be carried out by mail and involves busy physicians, frequent delays can be anticipated. It is difficult to predict the average amount of time the procedure would take, but experience indicates that the minimum would be one month from the time an author and topic are suggested and the program unit is added to the data bank. If the validation process results in changes, this could be much longer.

Experience with the Wisconsin library indicates that initial production of a program unit involves a high degree of cooperation from all involved. However, review and updating after a year proves to be a difficult and time-consuming process. With a requirement to keep the data bank current, it may be necessary at times to select a new author when circumstances indicate that updating cannot be accomplished within a reasonable time period.

Conclusions

1. Initial development of the Data Base should be generally proportional to incidence of disease until sufficient data becomes available to identify informational needs.

With insufficient data available to determine size of the data bank, coverage of content areas, or specific program unit topics, an arbitrary goal of 1,000 program units proportionate to incidence of disease offers the best initial approach.

Data gathered in operation of the resource would then give guidance for refinement of the data base to be responsive to the information needs of physicians.

2. Specialty Societies would most appropriately provide the mechanisms for selection of topics and authors and validation of content.

While program units from existing services could provide the initial data base, the most appropriate selection of topics and authors can be done by informed opinion of practicing physicians through mechanisms established within their professional societies. This is also considered the best avenue for initial validation of content and annual review in cooperation with the author.

IV. Promotion

A. Publicity

In planning a publicity campaign directed at physicians, the primary concern is how to compete effectively with the myriad of others who are vying for the doctor's time and attention. A study conducted in 1952 showed that the average physician received 10.6 pieces of direct-mail advertising per day (3,300 per year), subscribed to 6.6 medical journals, and saw an average of two detail men each day.[1/] We can only assume that these figures have increased since then.

Publicity Goals

Publicity for a national medical DAIRS must first gain the doctor's attention, then persuade him to try the service, and finally encourage him to adopt it for his continued use.

The goal of the publicity campaign for the national medical DAIRS has four stages. They are:

(1) Awareness

(2) Interest

(3) Trial

(4) Adoption

The physicians's adoption or continued use of the service will depend on the service itself. If he is unhappy with the content of the one tape he has heard, all the publicity in the world may not get him to change his mind.

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1. Caplow, Theodore. "Market Attitudes: A Research Report from the Medical Field." Harvard Business Review, 30:105-112, 1952

Literature Search

Some studies have been conducted on how to reach physicians but most are concerned with drug promotion and therefore relate only incidentally to the problem of persuading the physician to establish a new consultation pattern.

The majority of the studies were done in the 1950's and therefore much of the information, especially that relating to costs, has become long outdated. The studies have limited value since they authenticated widely held beliefs but failed to give much insight into the specific problem. Each showed that some doctors respond better to direct mail, others respond to journals, while still others prefer conventions or hospital staff meetings.

Options

A literature search and conversations with individuals who have had experience in medical promotion revealed the following publicity options:

1. Direct Mail
   a. Complete indexed brochure to each physician
   b. Complete indexed brochure to hospital chief of staff or continuing education director; abbreviated brochure to each physician.
   c. Ring notebook with thumb index to each physician; file sheets listing new program units as they become available.
   d. File card box with cards listing program units to each physician.
   e. Letter to physicians' secretaries telling them about dial access.
   f. Wallet cards with dial access phone number to remind physicians of the service.

2. Press Releases

   Releases announcing and explaining the new national medical DAIRS should be sent to:

   a. Medical journals
   b. Non-scientific medical publications such as Medical Economics, Medical World News, AMA News, and Medical Times.
   c. Selected newspapers
   d. Selected lay magazines

3. Journal Advertising
   a. State medical journals
   b. Regional medical journal groups such as State Journals West
   c. Journals with nationwide circulation such as JAMA and the New England Journal of Medicine

4. Exhibits at national conventions and meetings as well as at state and county meetings.
5. Monthly column in one or more medical publications listing new tapes available.
6. Speakers at county and state medical meetings

Discussion of Options

Direct Mail

This is one effective method of placing the indexed tape brochure in the physician's hands. This may be the most important aspect of publicity, for without the brochure, it is difficult for the physician to use the service. Initially, a complete brochure would be mailed to each physician and as an additional reminder, a wallet card with the dial access phone number would be sent.

The design of the brochure would be similar to the one now in use in Wisconsin, i.e. two-color, 9 inches by 4 inches. The dial symbol is appro-

priate, but could be more medically oriented by the addition of a caduceus.

Experience in Wisconsin, Minnesota, and North Dakota shows that the use of the dial access service corresponds positively to brochure mailings (See Table IV-A-1). Therefore, a simultaneous mailing to all doctors in the United States when the nationwide service is initiated would result in overuse of the telephone line, busy signals, and irate physicians who might not attempt to use the service again.

To avoid this, direct mailings in stages according to geographical regions should be considered. The country can be divided into four regions: Midwest (11 states); Northeast (15 states); South (12 states) and West (15 states).

News Releases

The news of a national dial access library should reach physicians directly before it is circulated to the lay press. Therefore, a general news release should be sent to medical journals and non-scientific magazines such as Medical World News and Medical Economics. (In addition to the news releases, it is probable that the non-scientific journals will use a feature story on the service).

After the physicians have been informed of dial access, articles in the lay press should appear. This serves not only as public relations for the sponsoring agency, but also lets patients know about the service.

Medical Journal Advertising

Journal advertising should be done prior to the first direct mailing so that when physicians receive the tape index brochure inthe mail they will be familiar with the concept and term "dial access." The advertisements should be the same in all journals at least for the first year. With a new product or service, it is better to present one image again and again rather than

Table IV-A-1

Daily Volume of Calls
Per 1,000 Physician Population

Month	Wisconsin	Minnesota	North Dakota
1	7.73 [a]	5.53 [a]	14.27 [a]
2	7.10		4.45
3	4.21		5.45
4	3.08	2.13	1.66
5	3.27	1.28 [e]	3.32 [e]
6	2.49	1.61 [e]	4.63 [e]
7	1.77	1.35 [e]	4.86 [e]
8	1.25	1.17	3.68
9	5.23 [a]	.84 [e]	2.79 [e]
10	4.56		4.41 [b,e]
11	3.56		
12	2.12		
13	2.98 [c]		
14	2.45 [d]		
15	2.82 [d]		
16	2.30		
17	1.81 [d]		
18	2.56 [b,d]		
Average	3.40	2.22	4.55

(a) Brochure mailed to all physicians in state.
(b) Supplement to brochure with index to all tapes mailed to all physicians in state.
(c) Self-test mailed to ±800 General Practitioners in Wisconsin.
(d) Self-test mailed to 200 General Practitioners and ±150 hospitals in Wisconsin.
(e) Self-test mailed to some physicians in Minnesota and North Dakota.

a series of different and perhaps confusing ones. Journal advertising will also enable those who have an interest in the service but have not yet received a brochure to access the library or write for a brochure.

The advertisement should be a two-page (back-to-back) black and white insert with the top half explaining briefly what dial access is and bottom half a perforated self-address postcard that the physician could tear out and send in to receive a copy of the tape index brochure. The number of requests received would help to determine future advertising policy.

The journals in which advertisements should appear have been chosen on the basis of the geographical area they cover and their influence as determined by physicians themselves. Specifically, the results of readership survey conducted by the Readership Bureau in Seattle, Wash., have been used. The results coincide closely with other readership surveys which have been conducted. According to the physician survey the most read and most influential journals are:

1. JAMA
2. Medical Economics
3. Northwest Medicine
4. New England Journal of Medicine
5. Medical Times and Archives of Internal Medicine

The use of the existing dial access library demonstrated that the major users of the library are family practitioners. Therefore, the Journal of the Family Physician/GP has been added to the list of journals in which a national medical DAIRS might be advertised. Another group of regional journals which includes the Rocky Mountain Medical Journal, California Medicine, Arizona Medicine and Northwest Medicine has been added

to the list of journals in which a national medical DAIRS might be advertised. This will be listed under the heading of State Journals West. The group of 33 state medical journals has also been included.

4. Exhibits

Exhibits at both national and regional conventions have several advantages for promoting a national medical DAIRS. New information about dial access can be brought to the physician with little delay, the physician can spend as much or as little time studying the display as he wishes, and most important, the exhibit gives the physician an opportunity to ask questions or make comments on the spot.

Stabilizing Utilization

Promotion of the national medical DAIRS is a variable factor and can be increased or decreased to stabilize utilization levels as the case warrants. For example, if library use is above predictions to the point that queing becomes a problem, promotion can be slowed down or temporarily halted. If use falls below the number of phone calls projected, journal advertising or direct mailing could be increased.

Costs

1. Brochure (Based on a mailing of 75,000 pieces)

	51 pages (2 oz.)	59 pages (3 oz.)	67 pages (4 oz.)	75 pages (5 oz.)	TOTAL
Printing	$10,000	$11,500	$13,000	$15,000	$49,500
Addressing	750	750	750	750	3,000
Handling	450	450	450	450	1,800
Postage (bulk rate)	750	1200	1500	2000	5,450
TOTAL	$11,950	$13,900	$15,700	$18,200	$59,750

2. Wallet card (Based on mailing of 75,000 pieces)

Plastic card	$3,110
Addressing	750
Handling	450
Postage	420
TOTAL	$4,730

3. Journal Advertising (Based on a two-page black and white insert run once)

JOURNAL	CIRCULATION	COST*
JAMA	210,000	$3961.00
New England Journal of Medicine	100,000	2295.00
State Journals West	38,300	1198.00
State Medical Group	151,000	17,034.00
Amer. Family Physician/GP**	112,750	3500.00
TOTAL	612,050	$27,988.00

* Includes 15% agency discount

** Effective January 1, 1970, the American Academy of General Practice will merge its two medical magazines GP and American Family Physician into one publication.

4. Exhibits

Exhibit design and construction	$5,000
Expense per showing	
Booth Rental	$800
Shipping	100
Staffing	100
Travel Expenses	150
Telephone Service	50
TOTAL	$1,300

5. News Releases

Issuing of press releases and writing of feature articles or special columns are not individually budgeted since this can be accomplished within the operating budget.

CONCLUSIONS

1. The basic promotional method for the resource should be direct mail with a six month promotional cycle.

Experience with operating libraries has proved that direct mailing of brochures is an effective promotional method. It places the index in the hand of the user and provides instructions on accessing the data bank.

For reasons of economy, it is recommended that each physician receive only one brochure a year. The mailings should be phased in four or more segments to avoid excess utilization immediately following promotion. With more frequent printing and distribution new program units can be publicised as they are added to the data base.

Wallet cards are expected to be an effective supplement to brochure mailings. While they would not provide an index, they would give instructions on accessing the data bank (with operator assistance to determine the program unit) and serve as a constant reminder of the service. They would also give encouragement to write for a brochure if the initial one had been lost or discarded. The wallet card would be mailed approximately six months after the physician had received his brochure.

2. Supplementary promotion and publicity should be carried out through journal advertising, press releases, columns and feature articles.

Since a large number of physicians respond to medical journal advertising, an effective way of announcing establishment

of the resource would be an advertisement in the Journal of the American Medical Association. JAMA has a large nationwide circulation (210,00) and an independent survey of reading habits of physicians showed that more physicians frequently read advertisements in this journal than in any other medical publication. Such an advertisement, with inclusion of a coupon, provides an opportunity for interested physicians to order a copy of the brochure.

Non-scientific publications with high physician readership would probably be receptive to news releases and feature articles pertaining to a national medical DAIRS. Since these publicity methods are relatively inexpensive they should be utilized frequently.

Similar efforts should be made to inform the public of the resource because of its public relations value to the sponsor and medical profession.

3. Promotion should be used as a tool to stabilize utilization.

Accurate predictions of utilization are difficult with available data, yet a reasonable estimate is necessary for budgetary purposes. Variation in telephone service requirements, for example, would greatly influence expenditures.

During the period when utilization levels fluctuate greatly promotion should be utilized to provide a measure of stability. Varying the volume and frequency of the planned direct mail promotions would be effective. Adding promotional efforts for specific geographic regions or types of physicians by either direct mail or journal advertising

or cancelling planned promotions would increase the ability to stablize use.

4. Studies should be conducted on the effect and relative value of the various types of promotion and publicity to refine the long-range promotional program.

The lack of recent research on the best methods of influencing physicians to utilize a resource such as the national medical DAIRS indicates a need for careful analysis of experience to determine how to best promote utilization on an economical basis. Such data may also be useful to others involved in dissemination of medical information.

IV. Promoting Utilization

B. Indexing.

Once publicity has created an interest in the information retrieval system, a key to the physician's initial trial and continued use of the service is the ease with which he can access the data bank. This necessitates a convenient method by which he can determine if the desired information is available and, if so, the procedure by which he can obtain that information.

A simplistic approach would be to provide the physician with only the telephone number and provide staff who would serve as reference librarians to determine the specific information need, select the appropriate program unit, and complete the telephone connection. This would have major economic implications, however, in that it would increase the continuing staffing requirements and telephone holding time. It would also limit progress toward complete automation of the service.

For these reasons it is desirable to explore various methods by which the physician could be furnished sufficient information to make his selection prior to placing the telephone call. If such a method can be devised and physicians familiarized with its use, maximum system efficiency and user satisfaction can be achieved.

The first requirement is an indexing system by which the potential user can determine which, if any, of the program units appears to be appropriate for his specific informational requirement. Discussion with medical librarians, particularly those directly involved with processing information requests from practicing physicians, presents a discouraging picture in adoption of an existing system for the unique requirements of a national medical DAIRS.

Most of these systems are developed for categorizing a volume of units far in excess of the 1,000 proposed for a national medical DAIRS. Consequently, such an index becomes unwieldy in that there are as many headings and subheadings as there are program units. Secondly, there seem to be some indexing problems unique to medical science in that there is disagreement as to whether units should be categorized by disease or condition, the body system involved, or the specialty field involved. The system that is based on only one of these requires that the user of the index adjust to the frame of reference of those who developed it. Those which attempt a combination of two or more become quite complex and confusing to use. A third complication is that experience indicates physicians as a group will not be tolerant of an indexing system which is inconvenient or time-consuming to use, and will abandon the service after unpleasant experience with it and seek their information from other sources.

Options

The following options are available to meet the indexing needs of a national medical DAIRS:

1. Classification

This involves division of the total information into a number of logical categories and then listing the units under these categories.

The Dewey Decimal System and the International Classification of Diseases are examples. There is the option of single-level classification which assumes equality among all categories, or generic classification which allows subordinated classifications. An attempt to classify a portion of the present Wisconsin library within the International Classification of Diseases results in the following example:

Infective and Parasitic Diseases	Tape No.
Other Bacterial Diseases	
Acute Bacterial Meningitis in Children	29
Management of Septecemic Shock	172
Tetanus Prophylaxis	21
Viral Diseases Accompanied by Examthem	
Measles Vaccination	85
Other Viral Diseases	
Management of Rabies	65
Syphilis and Other Venereal Diseases	
Syphilis Serology, Testing	66
Treatment of Acute Syphilis	145
Neoplasms	
Malignant Neoplasm of Digestive Organs	
Abdominal Tumors in Infants	101
Second Look Operation for Abdominal Malignancy	58
Malignant Neoplasm of Respiratory System	
Cancer of the Larynx	141
Cigarettes and Cancer of the Larynx	223
Early Diagnosis of Stomach Cancer	178
Radiotherapy in Management of Cancer of Larynx	185
Rehabilitation of Post-Laryngectomy Patient	142

2. Subject Headings

This again involves dividing the total information into logical categories and presenting the units under an alphabetical listing of these headings. The Yellow Pages of the telephone

directory presents perhaps the most familiar application of this method. Again there is the option of a single-level or multiple-level listings. The present Wisconsin library is indexed under this system, with a partial listing as follows:

Allergy

Anaphylaxis, Management of	76
Asthma, Bronchodilator Aerosols for	287
Asthma, Office Treatment of	166
Asthma, Problems of Aerosol Treatment	199
Bee Sting, Treatment of	88
Hay Fever, Office Treatment of	198
Penicillin Allergy	280
Serum Sickness	165
Status Asthmaticus, Management of	3
Urticaria, Diagnosis and Treatment	167

Blood and Lymphatics

Agranulocytosis, Management of	251
Anemia: Hypochromic, Microcytic	244
Anemia of Leukemia, Management of	277
Coumarin and the Anticoagulants, Management of Toxicity	195
Coumarin Anticoagulants: Potentiators and Antagonists	258

3. Coordinate Indexing

This involves a matrix arrangement of the information, with the use of key words to determine the coordinates. At the intersection of the coordinates are the units appropriate to that combination of key words. It is most usable for automated information retrieval. An example, using units from the Wisconsin library, would be:

	Respiratory	Skin
Allergy	166 - Office Treatment of Asthma	88- Treatment of Bee Stings
Infection	276 - Upper Respiratory Infection in Children	
Neoplasms	141 - Cancer of the Larynx	116 - Carcinoma of the Skin
Trauma	68 - Acute Crush Chest Injury	69 - Management of Acute Thermal Burns

4. Automatic Indexing

This also involves key word selection, with an alphabetical listing of all units containing the key word or words specified. A variation of this is the permuted index which operates on titles assigned to units, with every significant word in the title allowed to be placed alphabetically in order. An example of this, again using a portion of the Wisconsin library:

Abdominal Aorta, Aneurism of	232
Abdominal Tumors	101
Abruptio Placenta	45
Abcess, Lung	162
Abcess & Fistulae, Perirectal	238
Acidosis, Diabetic	39
Acute Alcohol Withdrawal	255
Acute Bacterial Meningitis	29
Acute Cardiac Decompensation	128
Acute Cardiac Infarction, Diagnosis of	129
Acute Cardiac Infarction, Treatment of	130
Acute Eye Injury	149

In the listing just presented, the first title would appear three times, as follows in the total listing:

Abdominal Aorta, Aneurism of	232
Aneurism of Abdominal Aorta	232
Aorta, Aneurism of Abdominal	232

If the user entered the index with any one of the three key words, he would obtain the program unit number which could then be touch-toned into a fully automated DAIRS or given verbally to the operator of a manual or semi-automatic system.

Availability

Once an indexing system is selected, there are a number of methods in which it could be made available to the potential user of the system. Perhaps the simplest would be a booklet or brochure with the printed index. Or the information could be placed on cards for manual sorting, or perforated cards for either needle sorting or machine sorting. If computerized, there could be access by remote teletype terminal or cathode ray tube presentation.

Depth of Information

There is also question of how much information the potential user desires or requires about the program unit before he makes a selection from an indexing system. The examples given present only the title. The user might also desire the name of the author, his title or affiliation, the length of the program unit, the date on which it was recorded or last updated, or a summary of the content.

Discussion

In evaluating the various indexing options, classification appears to be inappropriate for the unique requirements of a 1,000

program unit national medical DAIRS. The present medical classification systems are oriented to accomodating large volumes of listings and consequently have a large number of categories and sub-categories. Elimination of entire levels of sub-categories tends to make them incomprehensible; retention of only those categories required tends to destroy the logic of the systems. A final, significant limitation is that the system tends to reflect the decision making process followed by the indexer, and the user must be able to follow his rationale or is likely to end up at a "dead end" without the information he requires from the index.

Use of subject headings appears to be a possible alternative. This system is most convenient if the user can precisely name the subject of his search; for those who do not know the subject it is impossible to use. It is felt that for a 1,000 unit library the use of subject headings, with one level of sub-headings would be adequate. This would require multiple listings of units since, as previously indicated, medical information tends to be sought on more than one rationale, e.g. the disease or condition as opposed to the body system involved. Success of this indexing system would depend greatly on the ability of the indexer to accurately predict the various rationales under which users would enter the system.

Coordinate indexing is considered inappropriate to the present requirements. It is most valuable in an automated indexing system, a capability that is not contemplated for the national medical DAIRS under existing communications technology. Also, the vocabulary is proportionately larger for a small number of

units in the collection, and becomes most efficient when there is a large number of units.

Automatic indexing has considerable appeal when viewed in relation to the requirements, particularly a permuted index based on the titles of the program units. If the title accurately reflects the content of the program unit, an attempt to enter the index with any one of the title words will result in acquisition of the unit number which is required to access the DAIRS. It does present some problems in that commonly used medical terminology, e.g. acute, chronic, treatment, diagnosis, etc. must be either eliminated as options or will result in lengthy, somewhat unmanageable listings. Also, some titles may have to be expanded to include logical generic terms, e.g. "Office Treatment of Hay Fever" (Allergy), so that the physician who enters the index with the generic term will in fact locate the appropriate program unit.

Regardless of the indexing system selected, it is felt that the potential user of the system would be interested in the author of the program unit. The length of the program unit and the date on which it was recorded or last updated and a summary of content are also considered useful but not essential information.

Conclusions

1. Both a permuted index and subject heading index should be utilized to provide optimum ease of entry into the system, with operator assistance available to those with special problems.

In an effort to provide the potential user of the national medical DAIRS with optimum ease of entry into the system, it is recommended that the basic promotional item be a printed brochure based on both the Permuted Index and Subject Heading Index.

The Permuted Index is suggested as the primary index, to enable the physician to select the program unit by title and obtain the numerical code necessary to call the library. The Subject Title Index would be the secondary method, and would be used by those who are unable to obtain the listing desired from the Permuted Index, or who wish additional information on the program unit. This additional information would be the name and title of the author, length of the program unit, and the date on which it was recorded or last updated. It is not considered feasible, due to size of the brochure, to include a summary of tape content; this can be adequately reflected in the title. A third method of topic selection would be to call the DAIRS and request assistance from the library operator; this would be available, but not encouraged. In this way it is felt the physician would be offered the optimum service at the minimum cost.

V. EVALUATION

The design, methodology and data analyses for an evaluation of a DAIRS should be based on the specific objectives used in establishing and operating the system. Three general considerations were given to developing an evaluation plan and are presented in the next three sections: first, the problem of defining the nature of an appropriate evaluation is discussed; secondly, alternative techniques for collecting the needed data are recognized; and third, a recommended plan for evaluation for the initial three years of the DAIRS is described.

Problem

The objective of the Dial Access Project is to establish and maintain an information service (consisting of taped mini-lectures, 4-7 minutes) which is primarily devoted to assisting practicing physicians in the delivery of medical care, and secondarily offers a special means for practicing physicians to keep up-to-date or review certain techniques and topics.

This objective implies two general areas for evaluation: the system of service operations, and the effects of the information service. The first area, the service system, requires--from an evaluation viewpoint--two questions to be answered:

1) Has the system been established in accordance with planning specifications?
2) Having been established, are the operational components of the system being maintained and improved in terms of the planning objective?

The second area, the effects of the information service, poses four questions for an evaluation plan:

3) Is the system being used by practicing physicians?
4) Do practicing physicians find the information useful?
5) Do practicing physicians actually apply the information to their delivery of medical care?
6) If applied, does the information acquired via the system beneficially influence the delivery of health care to patient?

A detailed listing of the components of the system and its possible areas of influence within the perspective of these questions is given in Table V-1. This listing specifies nineteen aspects of DAIRS which should define the foci of an evaluation plan.

Literature Search

A search was made in four areas of the pertinent literature for techniques and procedures which might be helpful in detailed specification of the evaluation plan: (1) studies of DAIRS (2) studies of education technology (3) theories and models of evaluation and (4) project development and management techniques.

The literature reporting DAIRS developments does not contain any major research or evaluation study. A few studies (such as those cited

TABLE V-1

Components of the DAIRS to be Evaluated

I. The System of Operations	
A. Content Selection	
1. Needs of physicians	Relevance to current health care demands
2. Up-to-date	Regular review for maintaining scientific quality
B. Scope of Library	
3. Number of tapes	Determine if pre-set goal(s) achieved
4. Subject-matter coverage	Identify areas of health care lacking taped information
C. Content Validity	
5. Authoritative	Expertise of content preparation
6. Scientific Status	Acceptability to the scientific medical community
D. Technology	
7. Function	Status of system operation by specified calendar dates
8. Distribution	Identify areas of country not being served adequately
9. Volume	Capacity to handle high numbers of calls
10. Urgency	Extent of immediate access
11. Language	Readability of recording for listener
12. Accuracy	Precise clarity of critical information
13. Cost	Preparation of costs based on other components
II. Use of System by Physicians	
14. Publicity	Stimulation of attention and opportunity for motivation
15. Calls	Type and location of callers
III. Use of Content by Physicians	
16. Medical knowledge	General and continuing education functions for physicians
17. Application to practice	Relevance of content to physicians' practice
IV. Impact on Patient Care	
18. Emergency Care	Appropriateness and useability in emergency situations
19. Patient Management	Extent of applications to patient management

in previous sections, e. g. Ofiesh[1]) were primarily concerned with the analysis of DAIRS components and aimed at identifying technological components. No major study was found concerning the effects in terms of the learning behaviors with respect to a) acquisition of information, and b) acquisition and application of skills or techniques. Grumbling (1968)[2] provides the most recent summary of the educational utilization of DAIRS and notes that, "There is very little literature available to date which presents information regarding the planning, designing, installing and use of Dial Access Information Retrieval Systems."

In the general field of educational technology the most relevant area is audio instruction. Few studies have been made in this area (See tabulations of the literature search Appendix I). A similar conclusion was reached several years ago by Lumsdaine (1963)[3] who stated, "Relatively little research has been conducted using purely audio presentation, although a considerable number of the research studies on audio-visual media have used transcriptions or tape recordings as accompaniments to a sequence of visual materials presented by filmstrip, by a series of slides, or, occasionally by booklet materials." Lumsdaine's survey, entitled, "Instruments and Media of Instruction" is one of the most authoritative surveys of research on educa-

1. Ofiesh, Gabriel D., Dial Access Information Retrieval Systems: Guidelines Handbook for Educators, Center for Educational Technology, The Catholic University of America, Washington, D. C., 1968.

2. Grumbling, Henry, Dial Access Information Retrieval Systems in Higher Education and Implications for Establishing a System at Colorado State College, Dissertation, University Microfilms, Ind., Ann Arbor, Michigan, 1968.

3. Lumsdaine, A. A., Instruments and Media of Instruction. Chapter 12 in N. L. Gage (Editor) Handbook of Research on Teaching, Chicago: Rand McNally, 1963.

tional technology. He strongly recommends experimentation as the most desirable form of evaluation but does warn of the several dangers in studies comparing one device or medium with another. The main emphasis of his review is given to basic research of learning via media; no guidelines are given in his review pertinent to the development and evaluation of media systems.

Literature concerning evaluation theories and models has been recently summarized by Glass (1969).[4/] He describes four basic models: the Tylerian Model (Smith and Tyler, 1942;[5/] and Tyler, 1951);[6/] the Accreditation Model (e. g. the North Central Association evaluation program); the Management-Systems model (e. g. Guba and Stufflebeam, 1968);[7/] and the Formative-Summative model (Scriven, 1967).[8/] Of these possibilities the general approach suggested by the Formative-Summative model and the Management-Systems model have been followed in developing the evaluation plan described here. The main reason for using these approaches as a perspective is that the successful establishment of DAIRS needs 1) auditing during its formative period, and 2) no terminal or experimental comparison of the systems is possible. Once the system is established certain experimental studies will be possible on specialized aspects of its functions and

4. Glass, Gene V., The Growth of Evaluation Methodology. Laboratory of Educational Research, University of Colorado, Boulder, Colorado, 1969.

5. Smith, Eugene R., and Tyler, Ralph W. Appraising and Recording Student Progress. New York: Harper & Row, 1942.

6. Tyler, Ralph W., The functions of measurement in improving instruction. In E. F. Lindquist (Editor) Educational Measurement. Washington, D. C. American Council on Education, 1951.

7. Guba, Egor G. and Stufflebeam, Daniel L., Evaluation: The Process of Stimulating, Aiding and Abetting Insightful Action. Presented at the Second National Symposium for Professors of Educational Research: Boulder, Colorado, 1968.

8. Scriven, Michael. The Methodology of Evaluation. In Stake, R. E. (Ed.) AERA Monograph Series on Evaluation No. 1 Chicago: Rand McNally, 1967.

effects.

Various techniques for project management and development monitoring have been applied to educational technology applications. Two publications were consulted, Project Management (Baumgartner, 1963)[9/] and PERT/Applications in Education (Cook, 1966).[10/] The basic, fundamental steps of network construction have been used in planning the evaluation, but more complex PERT systems do not seem warranted, or justifiable cost-wise, for the proposed DAIRS.

Alternative Procedures

Consideration of alternative procedures were made for 1) the monitoring and review of developments to establish the operational system and 2) the effects of the information system.

Techniques for monitoring developments range from simple calendar planning to PERT-cost and PERT-time procedures. The full-fledged procedures of PERT and Critical Path Analysis are complex and sophisticated and are not appropriate to this study. The basic principles of these techniques--detailed planning relations among the activities and events--are however most desirable and are applied here in a limited form, see Tables V-2, V-3, and V-4.

Procedures for evaluating the effects of DAIRS can be summarized as follows:

9. Baumgartner, John S., Project Management, Homewood, Illinois: Richard D. Irwin, 1963.

10. Cook, Desmond L., PERT/Applications in Education. Washington, D. C.: U. S. Office of Education, OE-12024 Monograph No. 17, 1966.

TABLE V-2

Source and Method of Data Collection

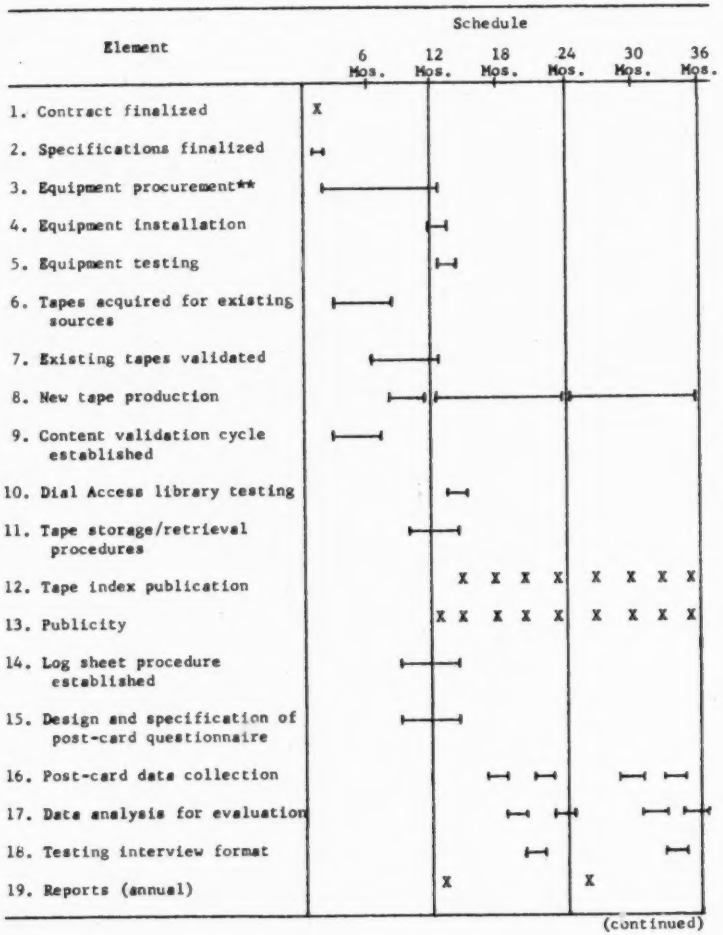
Component (Also see Table 1)	Object of Evaluation (Abbreviated from Table 1)	Data Collection
1. Physician Needs	Relevance	Distribution of tapes according to ICDA, and compared to other criterion (e.g. disease incidence)
2. Up-to-date	Maintaining quality	Periodic audit of records on tape reviews
3. Number of Tapes	Schedule progress	Periodic counts
4. Subject-matter coverage	Scope of service	Distribution of tapes according to ICDA, and compared to other criterion (e.g. disease indidence)
5. Authoritative	Quality of script preparation	Review of records and script writer qualifications
6. Scientific status	Validity of knowledge	Summary of review panel records
7. Function	System status	Periodic audit based on Development Schedule (See Table V-3)
8. Distribution	Service areas	Log sheets
9. Volume	Demand	Log sheets
10. Urgency	Accessibility	Busy signal study
11. Language	Readability	Post cards and special tests
12. Accuracy	Precise clarity	Post cards and special tests
13. Cost	Budgeting	Coordination of Development Schedule (See Table V-3) and Budget actual expenditures
14. Publicity	Visibility	Dates of publicity efforts coordinated with (8) and (9)
15. Calls	Caller characteristics	Log sheets and MD directory

(continued)

Component (Also see Table 1)	Object of Evaluation (Abbreviated from Table 1)	Data Collection
16. Medical Knowledge	Dissemination	Post card questionnaire
17. Application to Practice	Applicability	Post card questionnaire
18. Emergency Care	Usability	Post card questionnaire
19. Patient Management	Impact	Post card questionnaire and telephone interview

TABLE V-3

Bar Chart Plan of DAIRS Development Schedule*
(Automatic and Semi-Automatic Technical Systems)



(continued)

* A network of activities and events can be evolved from this chart; see, for example, John S. Baumgartner, Project Management, Richard D. Irwin, Inc., 1963.

** If a Manual Technical System were selected the equipment procurement period would be shortened to two months, and result in changes in scheduling other elements.

TABLE V-4

Selected Data Matrices for Use in Evaluation

Purpose and Matrix Dimensions	Source of Data
A: To identify pattern of demand on library Matrix A: Day/Month; Hour; DV-Frequency of Calls	A: Log Sheet
B: To identify characteristics of the users according to frequency of calls and location Matrix B: Location/Demographic (e.g. Rural-Urban); Type of Practice and Physician Speciality; DV-Frequency of Calls	B: Log Sheet, Physician Directory, and Census Information
C: To determine demand for tapes according to frequency of request and medical classification Matrix C: Physician Specialty/Demographic; Medical Classification of Tapes; DV-Frequency of requests	C: Log Sheet, International Classification of Diseases, and Census Information
D: To determine extent of uses made by users according to kinds of applications and medical speciality Matrix D: Physician Speciality/Demographic; Kinds of Applications; DV-Physician Responses	D: Post card questionnaire, Physician Directory, Census Information, and Telephone Interview

NOTE: DV = Dependent variable to be used for initial analyses

Topic	Approach A	Approach B
1. Caller Identification	Machine recording as for an answering service	Operator, using log sheet
2. Reactions to tape	Questionnaire	Post cards (using item sampling)
3. Use and applications	Personal interviews	Post cards and telephone interviews
4. Impact	Observations in hospitals and clinics	Personal interviews and experimental studies

On the basis of two years experience with the Wisconsin evaluation procedures the procedures listed for Approach B produce the desired information and are economical. Approach A might yield in-depth information for Topics 2, 3 and 4, but it is felt the costs involved relative to the importance of the information do not justify its application.

The key, critical element for cost and quality of data collection is the sampling procedures. Efficient and economic sampling plans can be properly designed (Cochran, 1953;[11] Sudman, 1967)[12] when minimal basic information is accumulated. Decisions among alternatives need to be considered in detail following the gathering of data on callers during the first three months of operation. The major alternatives will be defined in terms of sample size, most likely the choice between 20% or 50% of calls stratified on the basis of three factors: (1) caller's medical specialty, (2) category of tape requested, and (3) census region of the country. By collection of minimal information during the first three

11. Cochran, William. Sampling Techniques. New York: John Wiley & Sons, 1953.

12. Sudman, Seymour. Reducing the Cost of Surveys. Chicago: Aldine Company, 1967.

months of operation empirical distributions can be constructed and economic, efficient samples realistically drawn for consequent, more detailed data collection. Data collected in later months can be used to check for changes in the distribution of calls, and thereby lead to any necessary changes in the sampling design.

Design and specification of the specific evaluation plan can be composed of many different combinations of the DAIRS components, data collection procedures, and levels of sampling precision (realistically ranging from 10 percent to 50 percent using multivariate stratified sampling procedures). From a practical, feasible viewpoint three options seem to be realistic (these options are also described in Section VI - Costs):

Option 1: Analyze office records and conduct telephone "busy" studies. This will primarily determine if the service system has been established in accordance with planning specifications and provide some information on whether operational components are being maintained and improved in terms of the planning objective.

Option 2: Log a random sample of calls for the 12-month period, analyze office records, conduct telephone "busy" studies, and conduct special studies of 6-week's duration for two periods during the year. This will provide data related to all 19 evaluation components, but may have a weakness in assessing impact on patient care.

Option 3: Log a random sample of calls for the 12-month period, analyze office records, conduct telephone "busy" studies, conduct two special studies of 6-week's duration and one telephone survey of 6-week's duration during the year. This will provide data related to all 19 evaluation components and the telephone surveys will provide a more effective evaluation of impact on patient care.

Excluded from these options is an in-depth investigation of the impact of DAIRS on patient care and management. Results of implementing Option 3 would provide general indications (revealed by physicians' self-reported perceptions and attitudes) as to whether information from DAIRS was entering into the actual procedures of patient care and management. Any further study of impact would need to be undertaken as an independent research project with a relatively large amount of funding.

Conclusions

1. The development schedule should be monitored from the start of the project until the system becomes operational.

The basic elements of the evaluation plan are presented in Tables V-2, V-3, and V-4. During the first x months up until the system first becomes operative, the primary concern will be for monitoring the development schedule. It is expected that this could be satisfactorily performed by project staff members with occasional assistance from a consultant for planning and methodology.

2. During the first twelve months of operation data should be gathered on the system of operations and instruments designed and tested for future measurement of use of the system and content by physicians and impact on patient care.

As shown in Table V-3, data collection in the first 12 months of operation will involve 1) minimal log sheet information by the regular operators, and 2) two periods for detailed studies which will require additional operator staff and clerical assistance. During the first year construction and try-outs of four designs for post-card questionnaires will

be performed and trials will be made for testing a format for special telephone interviews. Statistical consultants will be involved for a careful study of sampling designs and stratification procedures.

3. During the second twelve months of operation data should continue to be gathered on the system of operations and data collection should begin in the areas of use of the system and content by physicians and impact on patient care.

The major period for data collection will be the second 12 months. During this time three main study periods, each of six weeks, will be performed.

4. The third year should be devoted to analysis of data gathered in the first two years of operation.

Data collected during the first two years will be analyzed according to the general plan given in Table V-4. Further advanced analyses will be performed during the third year when the parameters of the system are expected to stabilize. During this period times series analysis of variance may be performed to identify significant trends in the developmental changes which occurred in the first twenty-four months of service.

VI. Costs

The presentation of cost estimates is essential in determining the feasibility of a national medical DAIRS and in providing a potential sponsor with an anticipated level of commitment. However, as indicated previously, there are limitations to the reliability of certain cost projections. Also, there are cost options which will vary according to decisions made in establishing such a resource.

Telephone Service

Option 1: Toll-free access to the resource for any physician within the contiguous 48 states through provision of In-WATS service adequate to meet projected needs.

Area 3 lines:	6 full-time	$93,600
	4 measured-time	12,480
Area 6 lines:	6 full-time	140,400
	4 measured-time	16,080
Area 9 lines: (Wisconsin)	1 full-time	7,200
	1 measured-time	2,700
Excess use of measured-time		25,140
Total		$297,600

Option 2: 23 incoming local exchange lines which physicians may access on a charge-per-call basis.

Line charges	$ 2,070
Recorder couplers	966
Total	$ 3,036

The In-WATS costs in Option 1 and the number of local exchange lines in Option 2 are based on projections made with limited utilization data. From a practical viewpoint, if Option 1 is selected a specific utilization goal should be set and promotion varied to maintain a level of utilization at or near this goal. In this way a sponsor of the service could be given the necessary budgetary information in advance of the commitment. When the library has stabilized over a period of time, the utilization goal and informational needs of physicians could be equated.

Hardware

Option 1: A system capable of automatic and semi-automatic operation capable of providing access over 23 incoming telephone lines to 1,000 program units of 4-7 minutes duration. (Costs are based on the Ampex equipment referred to elsewhere in this report):

Basic system	$229,200
Interface data sets	26,450
High-speed master	7,500
Total	$263,150

Option 2: A system capable of automatic and semi-automatic operation capable of providing access over 23 incoming telephone lines to 640 program units of 4-7 minutes duration. (Costs based on Ampex equipment):

Basic system	$185,450
Interface data sets	26,450
High-speed master	7,500
Total	$219,400

Option 3: A manual system capable of providing 1,000 program units 4-7 minutes in duration over 23 incoming telephone lines. (Costs are based on Cousino equipment used in present Wisconsin library):

Tape repeaters	$3,450
Cartridges	8,000
Total	$11,450

The three options given represent what are felt to be rational alternatives depending on whether a manual or automatic and semi-automatic system is desired and whether total capacity is required initially. The cost of the manual system could go as high as $25,000 if equipment other than the Cousino repeaters were preferable. The cost of a combined automatic and semi-automatic system could be either higher or lower, depending on the configuration desired, but this system is considered the best option available at this time for automatic and semi-automatic operation.

Development of Data Base

Option 1: Start with initial library of 300 tapes which must be validated and re-recorded, and add 125 new tapes during the year, with an author's honorarium of $100 for new tapes and $25 for each tape which is updated:

Author's honoraria	$20,000
Announcer's fee	4,250
Total	$24,250

Option 2: Start with initial library of 300 tapes which must be validated and re-recorded and add 125 new tapes during the

year with no honorarium for new tapes and a $25 honorarium for each tape which must be updated:

Author's honoraria	$7,500
Announcer's fee	4,250
Total	$11,750

Option 3: Same as above, but with no fee to authors.

Announcer's fee	4,250

Personnel

Option 1: Staffing of a resource providing automatic and semi-automatic access to the data bank:

Director	$15,000
Technical Supervisor	13,000
Project Specialist	7,000
Secretary	5,500
Library Operators	22,000
Student Help	3,500
Medical Consultant - part-time	4,000
	$70,000

Option 2: Staffing of a resource providing access to a manual technical system:

Director	$15,000
Project Specialist	7,000
Secretary	5,500
Library Operators	30,800
Student Help	5,000
Technical Consultant - part-time	4,000
Medical Consultant - part-time	4,000
	$ 71,300

The position titles conform with academic and classified categories of the University of Wisconsin and salary levels are based on amounts paid for comparable performance at existing salary rates.

Supplies

General supplies, both office and technical, anticipated to be required for operation of a resource:

Office Supplies	$2,000
Technical supplies	7,000
Duplicating	1,000
Total	$10,000

Promotion

Option 1: Initial announcement of service with a two-page black and white insert in the Journal of the American Medical Association, four printings of 75,000 brochures and four mailings to provide coverage of all physicians in the country once in a 12-month period, production and four mailings of wallet cards to provide a reminder to each physician in the country once in a 12-month period, and miscellaneous promotional activities designed to stabilize utilization.

Brochure		
Printing	$49,500	
Addressing	3,000	
Handling	1,800	
Postage	5,450	
		$59,750
Wallet Card		
Production	$12,440	
Addressing	3,000	
Handling	1,800	
Postage	1,680	
		18,920
Advertising		
JAMA		3,691
Miscellaneous Promotion		20,000
Total		$102,361

Option 2: Eight printings of 75,000 brochures and eight mailings to provide coverage of all physicians in the country twice in a 12-month period and miscellaneous promotional activities designed to stabilize utilization.

Brochure		
Printing	$99,000	
Addressing	6,000	
Handling	3,600	
Postage	10,900	
		$119,500
Miscellaneous Promotion		20,000
Total		$139,500

Option 3: Initial announcement of service with a two-page black and white insert in the Journal of the American Medical Association, production and eight mailings of wallet cards to publicize the service to each physician in the country twice in a 12-month period, printing of limited quantities of brochures for response to requests, and miscellaneous promotional activities to stabilize utilization.

Wallet Cards		
Production	$24,880	
Addressing	6,000	
Handling	3,600	
Postage	3,360	
		$37,840
Brochure		
Printing	10,000	
Postage	4,500	
		14,500
Advertising		
JAMA		3,691
Miscellaneous Promotion		20,000
Total		$76,031

Evaluation

Option 1: Analyze office records and conduct telephone "busy" studies. This will primarily determine if the service system has been established in accordance with planning specifications and provide some information on whether operational components are being maintained and improved in terms of the planning objective.

Evaluation consultant	$1,000

Option 2: Log a random sample of calls for the 12-month period, analyze office records, conduct telephone "busy" studies, and conduct special studies of 6-weeks duration for two periods during the year. This will provide data related to all 19 evaluation components, but may have a weakness in assessing impact on patient care.

Printing	$ 280
Postage	1,350
Data Processing	7,200
Additional Office Staff	2,500
Additional Operators	3,000
Total	$ 14,330

Option 3: Log a random sample of calls for the 12-month period, analyze office records, conduct telephone "busy" studies, conduct two special studies of 6-weeks duration and one telephone survey of 6-weeks duration during the year. This will provide data related to all 19 evaluation components and the telephone surveys will provide a more effective evaluation of impact on patient care.

Printing	$ 280
Postage	1,350
Data Processing	8,700
Telephone Costs	8,400
Additional Office Staff	4,000
Additional Operators	3,000
Total	$ 25,730

Other Budget Categories

There are a few categories which can be expected to remain constant regardless of the options selected in the other budget classifications:

Travel	$ 1,000
Remodelling	10,000
Space Rental	5,000
Office Equipment	3,000
Total	$ 19,000

Budget Examples

Based on the options presented, it is possible to arrive at examples which offer guidance on the relative cost of optimum and minimum service configurations. They are as follows:

Optimum Capabilities

Telephone service (Option 1)	$297,600
Hardware (Option 1)	263,150
Data Base (Option 1)	24,250
Personnel (Option 1)	70,000
Supplies	10,000
Promotion (Option 1)	102,361
Evaluation (Option 2)	14,330
Other	19,000
Total	$800,691

Minimum Capabilities

Telephone service (Option 2)	$ 3,036
Hardware (Option 3)	11,450
Data Base (Option 3)	4,250
Personnel (Option 2)	71,300
Supplies	10,000
Promotion (Option 1)	102,361
Evaluation (Option 2)	14,330
Other	19,000
Total	$ 235,727

Conclusions

1. A national medical DAIRS which would meet the optimal service requirements of physicians could be established and operated for one year on a budget of approximately $800,000.

The study staff recommends toll-free access from the contiguous 48 states to an automatic and semi-automatic DAIRS with a data bank of 1,000 program units which have been developed and validated by peer groups. Promotion of this service would be on a six-month cycle based on direct mail contact. Evaluation would attempt to measure the service system, use of the system and content by physicians, and impact on patient care.

2. A system which would meet minimal service requirements of physicians could be established and operated for one year on a budget of approximately $235,000.

A system serving physicians in the contiguous 48 states, requiring the physician to pay for the telephone service, with

access to a data bank of 1,000 program units which have been developed and validated by peer groups, is considered a less desirable option. Promotion of such a service would also be based on direct mail contact and evaluation would attempt to measure the same parameters.

While it is not possible to determine the decrease in utilization due to the direct cost to the physician, the study staff believes that it would be significant. The hardware configuration would severely limit future development. Consequently, the conclusion is that such a system would make only limited use of the potential of such a service.

VII. Feasibility

The feasibility of establishing a national medical DAIRS involves three primary questions:

1. Is there a need for such a service?
2. Is the cost appropriate to the anticipated benefit?
3. Can such a system of service be established?

Need

Data from existing medical tape libraries indicate a significant number of physicians will use such an information retrieval service. The computations in Appendix 2, generally confirming a separate study by The Rand Corporation, predict a national utilization of 410,700 calls per year.

Patient Care

Evaluation data for nine months' utilization of the Wisconsin library (see page 2, Table I-1) indicates that 44.8 per cent of calls involve a specific patient problem. Projected nationally this would mean 183,994 patient related calls per year. The data indicates 20.5 per cent of calls are in regard to immediate or emergency patient problems; the national projection would predict 84,193 calls for urgent patient problems per year.

Continuing Medical Education

Based on the same evaluation data, 47.6 per cent or 195,493 calls per year to a national resource would be for educational purposes.

Cost vs. Benefit

Establishment of the level of service proposed by the study staff (See Section VI) would cost approximately $800,000 in the first year. During that period there would be an expected utilization of 410,700 calls, or a cost per call of approximately $2.00.

Change in Physician Behavior

Further analysis of the Wisconsin evaluation data indicates that 19.7 per cent of the calls resulted in a change of one or more items in the management of a specific patient and 12.8 per cent resulted in change of one or more aspects of medical practice. Therefore, a total of 32.5 per cent, or 133,477 calls, would be expected to result in a change in physician behavior.

If the value of the information retrieval system is restricted to accomplishing change in behavior, the cost based on a budget of $800,000 would be approximately $6.00 for each such change reported.

Providing New Information

The Wisconsin data indicates that 36.9 per cent of users gained new information related to the management of a specific patient and 33.2 per cent gained ideas for improving their general provision of patient care. Thus a total of 70.1 per cent, or 287,900 calls would result in transmission of knowledge.

If the system value is judged in terms of information dissemination, the cost based on a budget of $800,000 would be approximately $2.77 for each instance where a transfer of new knowledge could be expected.

Establishing a System

The three components in the required system are a data base, a hardware system for storage and retrieval of the information, and a nationwide communications network to access the system and data base.

A strategy has been proposed for development of an authoritative data base (Section III), a variety of hardware described and recommendations made on selection of suitable equipment (Section II-B), and the national telephone communications network described (Section II-A).

Conclusions

1. It is feasible to establish a national medical DAIRS.

Based on anticipated level of utilization and limited evaluation data there is reason to expect that such a service would meet physician needs in the areas of continuing medical education and information applicable to immediate patient care.

Cost of the service is considered to be within acceptable limits, whether based on total anticipated utilization, provision of new information, or expected change in physician behavior.

Specific information provided in other sections of this report establishes that a data bank can be developed, appropriate equipment can be obtained, and the necessary communications facilities are available.

Appendix 1

Survey of Literature

Sources: Dissertation Abstracts
Sociological Abstracts
Education Index
Psychological Abstracts

Topic Headings:

Adult Education
Advertising
Audio Visual Aids
A-V Equipment
A-V Cataloging
A-V Cost
A-V Instruction
Communications
Dial Access
Educational Innovation
Indexing
Information Storage and Retrieval Systems
Instructional Materials Centers
Language Laboratories
Learning Methods
Library Advertising
Magnetic Recordings
Publicity
Tape Recordings
Systems Analysis
Teaching Machines
Technical Education
Telephone
Telecommunications

Key Words:
Tests
Cost
Evaluation
Cataloging
Indexing
Specifications
Health
Medicine
Promotion
Publicity
Advertising
Physicians
Measures

Total Citations

	1965	1966	1967	1968	1969
Dissertation Abstracts	80	120	135	168	56
Sociological Abstracts	26	216	*	*	53
Education Index	512	499	445	406	194
Psychological Abstracts	153	93	140	179	171
Total	771	928	720	753	474

Total citations surveyed - 3,646

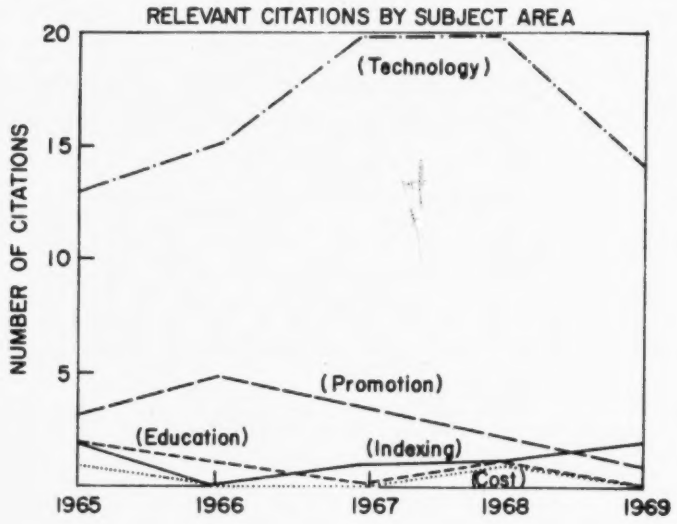
* Sociological Abstracts not surveyed for years indicated.

Relevant Citations

	1964	1965	1966	1967	1968	1969
Dissertation Abstracts		4	4	2	3	2
Sociological Abstracts		1	0	*	*	0
Education Index	7	12	15	16	14	7
Psychological Abstracts		2	6	6	6	0
Total	7	19	25	24	23	9
Percent Relevant	2.8	2.5	2.7	3.3	3.1	1.9

(*) Sociological Abstracts not surveyed for years indicated.

Figure AI-1



Appendix 2

Projection of National Utilization

A logical estimate of anticipated utilization of a national medical DAIRS can be obtained by projecting data from regional libraries currently in operation. It appears that data from the Wisconsin service are most generally usable, with data from the Minnesota and North Dakota services incorporated where possible. Data from the New Jersey service proved of value in one instance.

The following rationale was used:

1. Potential utilization will very according to the type of practice setting.
    a. Physicians involved in patient care.
    b. Physicians in a training status.
    c. Physicians in federal service.

Analysis shows that there is a difference between those in patient care and those in training, and while the data involving federal physicians are extremely limited they indicate a different rate of utilization from the other two groups.

2. Potential utilization by physicians involved in patient care will vary according to the demographic setting of their practices.

This thesis is based on the assumption that a resource such as the one proposed is directly related to the consultation

patterns a physician has established, and that use of the resource involves new or changed consultation patterns. It is generally agreed that the physician in a densely populated area has significantly greater opportunity for formal and informal consultation and that his patterns are more firmly established and more responsive to his needs. Conversely, the physician in a more remote area has fewer opportunities for formal consultation and few established channels for informal consultation. The proposed service is more likely to provide a more convenient method of obtaining information or to fill a void in his present consultation patterns. Whether this is the reason or not, the data indicate an inverse relationship between an individual's level of utilization and the density of population of his practice setting. (Figure A2-1). There is insufficient data to determine if this is equally true for physicians in a training status or federal service, so a single factor is established for each of these two groups based on the limited data available.

3. All of the following are significant factors in projecting available data to a national level:
    a. Time zone differentials.
    b. Annual increases in the numbers of physicians involved in patient care and in federal service.
    c. Increase in size of the data bank.
    d. Effect of promotion on utilization.

4. The amount of telephone service required is dependent

on identifying the peak utilization period of the day and subscribing to a level of service to meet this requirement within acceptable levels of queuing.

Refining Available Data

While the computations involved are not complex, the process is a lengthy one. The first step is to identify and eliminate inherent weaknesses in the data.

Total utilization figures available are as follows:

	Total Calls
Wisconsin (1-1-68 to 6-30-69)	9,075
Minnesota (9-16-68 to 5-31-69)	2,798
North Dakota (9-10-68 to 6-30-69)	913
Total:	12,767

The data from all three states have been gathered in a similar manner. At the time of the call to the library, the following data are recorded:

1. Time, day, month, and year of call.
2. Name of calling physician.
3. City of calling physician.
4. Type of practice (G.P., Specialist, Intern-Resident, Medical Student, or Other).

To make maximal use of this data, certain portions have been eliminated, as follows:

Wisconsin

Total Calls		9,075
Less:		
Non-medical calls	529	
In training status	2,534	
Heavy use, one physician	357	3,420
Total appropriate calls		5,655

(1) Non-medical calls are not expected to be a significant factor and are therefore eliminated. (2) Those in student status are deleted at this point, but will be considered later in the projections. (3) The one physician who called every tape in the library at least once in a 3-month period is a factor which has not been projected nationally for, while it may happen, every effort should be made to discourage this use of the resource.

Minnesota

Total Calls		2,798
Less:		
Calls (11-1-68 to 12-31-68)	631	
Calls (4-1-69 to 5-31-69)	296	
In training status	412	
Non-medical calls	19	1,358
Total appropriate calls		1,440

(1) Geographical location of the calls for the 4 months indicated was not available and consequently could not be used in projections. (2) Training status and non-medical calls were deleted for the reasons given previously, while the calls from those in training will be added later in the projections.

North Dakota

Total Calls		913
Less:		
Calls (10-1-68 to 11-30-68)	164	
Federal Physicians	84	
In training status	2	
Heavy use, one physician	170	420
Total appropriate calls		493

(1) Geographic source of calls not available for the two months indicated. (2) Both federal physicians and those in training will be applied to projections later. (3) Excess calls from one physician seem to be inappropriate for national projection (see 3. under Wisconsin data).

The projections are based on the following totals of utilization:

	Practicing Physicians	In Training Status	Federal Physicians
Wisconsin	5,655	2,534	0
Minnesota	1,440	412	0
North Dakota	493	2	84

Physicians Involved in Patient Care

The utilization data for practicing physicians have been broken down into the nine demographic county classifications presented in Distribution of Physicians, Hospitals and Hospital Beds in the U.S. - 1967, for purposes of projection. This reference classifies by non-metropolitan counties and Standard Metropolitan

Statistical Areas (SMSA). A SMSA is an area having: 1. a central city of 50,000 or more inhabitants; 2. the remainder of the county occupied by the central city; and 3. contiguous counties that are integrated economically and socially with the county containing the central city.

These demographic county classifications are as follows:

1. Non-Metropolitan counties with under 10,000 inhabitants.
2. Non-Metropolitan counties with 10,000 to 25,000 inhabitants.
3. Non-Metropolitan counties with 25,000 to 50,000 inhabitants.
4. Non-Metropolitan counties with over 50,000 inhabitants.
5. Counties considered potential SMSA's.
6. Counties in SMSA's with 50,000 to 500,000 inhabitants.
7. Counties in SMSA's with 500,000 to 1,000,000 inhabitants.
8. Counties in SMSA's with 1,000,000 to 5,000,000 inhabitants.
9. Counties in SMSA's with 5,000,000 or more inhabitants.

The number of calls from physicians involved in patient care by demographic county classification in the three states for which utilization data are available is as follows:

Calls from Physicians In Patient Care
By Demographic County Classifications

State	1	2	3	4	5	6	8	Total
Wis.	107	499	820	448	967	1,043	1,771	5,655
Minn.	33	272	248		94	109	684	1,440
N.Dak.	115	107	91	45	74	61		493

There are no SMSA's in classifications 7 and 9 in the

three states for which there is data available.

An arbitrary decision had to be made regarding calls from interns and residents in the Minnesota data. It was not possible to identify specific calls from Hennepin and Olmstad counties. Therefore, they were divided 25% Olmstad County and 75% Hennepin County, which appears logical in the context of the data. Each contains about half of the interns and residents in the state, but it was not statistically possible to assign half the calls to each since the total for Olmstad county in certain instances would have exceeded the number of calls actually received.

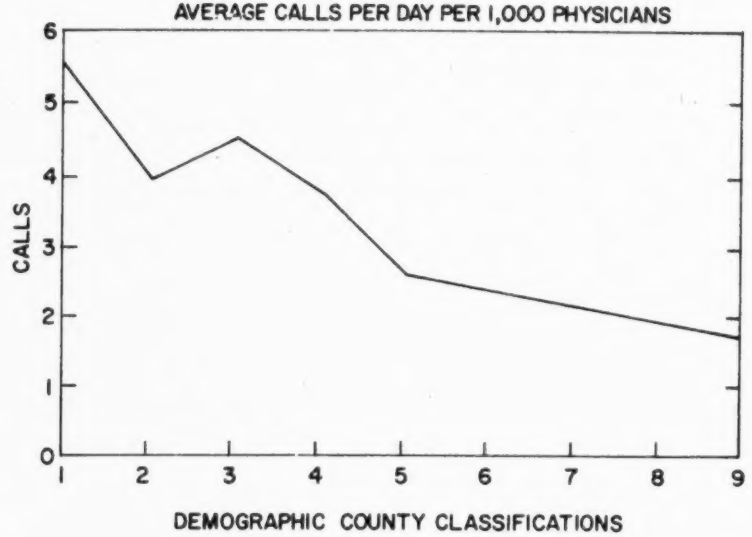
By dividing the number of calls in each demographic county classification within a state by the number of days and the number of physicians in thousands involved in patient care, it is possible to arrive at the calls per day per 1,000 physicians, as follows:

Calls Per Day Per 1,000 Physicians by Demographic County Classifications

State	1	2	3	4	5	6	8
Wis.	5.94	3.99	4.68	3.91	2.13	1.82	1.74
Minn.	5.06	4.90	3.73		.55	2.89	2.08
N.Dak.	5.79	2.91	4.88	3.65	5.37	2.09	
Ave.	5.60	3.93	4.43	3.78	2.68	2.27	1.91

This average is graphically presented as follows:

Figure A2-1



Factors for classifications 7 and 9 are estimated at 2.10 and 1.75 respectively, since there are no data available.

National Projection

With the utilization rates established for the county demographic classifications, it is possible to make national projections for physicians involved in patient care by multiplying

the number of appropriate physicians in each county classification nationally by the appropriate rate. The factor of time zone distribution is also introduced at this time since it will be required in later computations.

Physicians by Demographic County Classifications

Time Zone	1	2	3	4	5	6	7	8	9
E	486	2,690	5,123	7,645	6,113	18,142	21,885	48,556	27,291
C	1,041	5,034	4,967	2,746	3,557	12,624	5,562	15,712	10,110
M	538	880	819	799	108	2,117	2,292	2,293	0
P	94	399	672	1,484	870	4,027	4,355	13,149	11,965

E = Eastern C = Central M = Mountain P = Pacific

Applying the average calls per thousand physicians per day, as computed on the basis of the three currently operating libraries, to the numbers of physicians in the demographic county classifications by time zone, it is possible to calculate total calls anticipated per day from practicing physicians in each zone.

Number of Calls Per Day from Physicians In Patient Care by Demographic County Classifications

Time Zone	1	2	3	4	5	6	7	8	9	Total
E	2.7	10.6	22.7	28.9	16.4	41.2	46.0	92.7	47.8	309.0
C	5.8	19.8	22.0	10.4	9.5	28.7	11.7	30.0	17.7	155.6
M	3.0	3.5	3.6	3.0	.3	4.8	4.8	4.4	0.0	27.4
P	.5	1.6	3.0	5.6	2.3	9.1	9.1	25.1	20.9	77.2

Physicians in Training

To these figures, the calls anticipated from those in training (medical students, interns and residents) must be added. For this projection, only the Wisconsin data are used, since the promotion to this group was comparable to that directed to practicing physicians. Based on 2,534 calls in 546 days from a potential 1,495 individuals in training, the factor of calls per day per 1,000 individuals is 3.10. The national projection by time zone is:

Time Zone	Total In Training	Anticipated Calls
E	45,712	141.7
C	22,184	68.8
M	2,273	7.0
P	7,718	23.9

Physicians in Federal Service

The final group which must be considered are the 24,917 federal physicians involved in patient care. The only experience available deals with utilization of the North Dakota library, and while this may not be representative of the federal service as a whole, it is the only data available. Based on 82 calls from 100 physicians in 202 days, the factor of calls per day per 1,000 physicians is 4.06. The national projection is as follows:

Time Zone	Federal Physicians In Patient Care	Anticipated Calls
E	12,731	51.7
C	4,017	16.3
M	1,171	4.8
P	3,678	14.9

Increase in Physician Population

Since the data from Distribution of Physicians, Hospitals and Hospital Beds in the U.S. - 1967 are dated by 3 years, and there is approximately a 2.2% annual increase in the number of practicing physicians in the United States, this factor must be applied to both federal and non-federal data. The number in training remains relatively constant, so no similar factor is applied. The data are as follows:

Total Anticipated Utilization Per Day
(258 Program Units)
Federal and Non-Federal

	Patient Care Physicians				In Training	
Zone	1967	1968	1969	1970	1970	Total
E	360.7	368.6	376.7	385.0	141.7	526.7
C	171.9	175.7	179.6	183.6	68.8	252.4
M	32.2	32.9	33.6	34.3	7.0	41.3
P	92.1	94.1	96.2	98.3	23.9	122.2
Total	656.9	671.3	686.1	701.2	241.4	942.6

Increase in Data Bank

Another factor which can be expected to increase utilization of a national medical DAIPS is increase in size of the data bank. It is difficult to project the significance of this, since the present data deal primarily with a static library size of 258 tapes. On the basis of current data, it is projected that a 258 tape library would result in 942.6 calls per day on a national basis or a rate of 3.65 calls per tape. Two factors apply, however, which make it inadvisable to use this figure to project the effect of increase in the data bank. The first is that effort was made in production of the first 258 tapes to deal with the most pertinent subjects. As the library size increases, it could be expected that tapes would become progressively less related to physicians' greatest informational needs. The second factor is that 38.7%* of those using the Wisconsin library call in relation to a specific patient problem; the remainder use the service for educational purposes or call out of curiosity. It might be expected that this remaining 61.3% would make their selection from available tapes while the 38.7% may in fact not use the service if the appropriate tape is not available. For lack of a better rationale, it could be projected that adding one tape to the library would result in 1.42 additional calls per day per tape (3.65 X .39).

To increase the library from 258 to 300 tapes, then, would result in the following:

* Based on evaluation data gathered 1/1/68 through 9/30/68.

Time Zone	Calls for 258 Tapes	Calls for 300 Tapes
E	526.7	560.0
C	252.4	268.4
M	41.3	43.9
P	122.2	129.9
Total:	942.6	1,002.2

Telephone Service Requirements

To approach the problem of the telephone service necessary to accomodate this number of calls per day, it is necessary to examine the distribution of utilization. The data available from the three libraries and New Jersey show a high degree of correlation when computed by 6 hour segments:

	Percent of Calls Per Day			
Time Period	Wis.	Minn.	N. Dak.	N.J.
Midnight - 6 a.m.	2.9	5.3	2.6	3.6
6 a.m. - Noon	21.4	22.2	22.7	24.6
Noon - 6 p.m.	33.8	29.4	35.8	39.2
6 p.m. - Midnight	38.8	43.1	38.9	32.4
Not Ascertained	4.2	0.0	0.0	0.0
Total:	101.1	100.0	100.0	99.9

The Wisconsin data are available on an hourly basis, and with the high correlation above, this can be utilized to project volume of calls per hour, by time zone. When this is adjusted to account for the differences in time, the following projection is possible:

		Anticipated Calls Per Hour				
Hour (EST)	% of Total Calls	Eastern	Central	Mountain	Pacific	Total
12:01-1:00 a.m.	1.7	9.5	14.2	3.9	11.3	38.9
1:01-2:00	.6	3.4	4.6	2.3	11.6	21.9
2:01-3:00	.2	1.1	1.6	.7	6.9	10.3
3:01-4:00	.2	1.1	.5	.3	2.2	4.1
4:01-5:00	.1	.6	.5	.1	.8	2.0
5:01-6:00	.1	.6	.3	.1	.3	1.3
6:01-7:00	.4	2.2	.3	.0	.3	2.8
7:01-8:00	1.3	7.3	1.1	.0	.1	8.5
8:01-9:00	4.0	22.4	3.5	.2	.1	26.2
9:01-10:00	5.1	28.6	10.7	.6	.5	40.4
10:01-11:00	5.4	30.2	13.7	1.8	1.7	47.4
11:01-12:00	5.9	33.0	14.5	2.2	5.2	54.9
12:01-1:00 p.m.	5.4	30.2	15.8	2.4	6.6	55.0
1:01-2:00	5.9	33.0	14.5	2.6	7.0	57.1
2:01-3:00	6.2	34.7	15.8	2.4	7.7	60.6
3:01-4:00	7.0	39.2	16.6	2.6	7.0	65.4
4:01-5:00	4.9	27.4	18.8	2.7	7.7	56.6
5:01-6:00	5.5	30.8	13.2	3.1	8.1	55.2
6:01-7:00	4.4	24.6	14.8	2.2	9.1	50.7
7:01-8:00	5.6	31.4	11.8	2.4	6.4	52.0
8:01-9:00	7.2	40.3	15.0	1.9	7.1	64.3
9:01-10:00	8.7	48.7	19.3	2.5	5.7	76.2
10:01-11:00	8.9	49.8	23.4	3.2	7.3	83.7
11:01-12:00	5.3	29.7	23.9	3.8	9.4	66.8
Totals	100.0	559.8	268.4	44.0	130.1	1,002.3

Computations to this point have dealt with all but one of the factors affecting utilization - that of promotion. Records of the three operating libraries indicate this is significant, but the study staff was unable to identify the specific factor and had to eliminate it. The National Library of Medicine helped at this point by providing data from a separate study being conducted by the Rand Corporation involving other facets of retrieval of medical information. Both studies are based on the same data but use different approaches to the projection of utilization. A major difference is that the Rand projections involve the promotional effect. Since all other factors appear to be comparable, the difference of 12.3 percent between the projected levels of utilization predicted by the two studies can appropriately be attributed to assumption of a higher level of promotion than has been given to the operating libraries. This level assumes a 6-month cycle rather than an 8-month cycle, with some supplementary publicity. This is considered more appropriate to the needs of a national resource.

Adjusting computations to include this promotional factor brings the anticipated annual volume of calls to 410,700, with a daily average of 1,125 and a peak one-hour volume of 107.8 calls between 10-11 p.m.

Calls from Areas Without In-WATS Service

Projection can also be made of the anticipated level

of calls from areas not currently served by the national telephone network, nor having DDD access to the network. These are Alaska, Hawaii, and Puerto Rico.

	Anticipated Calls Per Day			
	Federal Physicians	Non-Federal Physicians	In Training	Total
Alaska	0	.5	0	.5
Hawaii	1.0	3.3	0.6	4.9
Puerto Rico	0	6.7	1.6	8.3

These computations are more crudely made than those preceding. It is not possible to determine the number of federal physicians in these areas, and the figures stated are based on estimates. Non-federal projections are on the basis of 3.66 calls per day per thousand physicians, rather than by demographic classification. Those in training are computed on the same basis as previous data.

Appendix 3
Determination of Content Area

Incidence of Disease or Indication of Educational Want or Need

ICDA Categories	NDTI (1)	GHI (2)	WIS (3)	Minn. (4)	N. Dak. (5)	N. Car. (6)	Can. (7)	PAS (8)	Perm. (9)
1.	1.8%	5.8%	2.5%	2.7%	2.4%	3.7%	3.0%	1.2%	--%
2.	2.7	2.3	7.3	7.0	6.2	1.5	2.2	8.4	--
3.	5.0	5.0	4.2	12.0	3.7	3.0	3.0	2.4	20.9
4.	1.8	.70	2.3	4.4	1.5	--	1.9	.17	4.5
5.	3.8	.40	7.5	6.7	5.2	6.3	3.5	3.0	9.9
6.	7.5	7.6	5.2	14.0	6.3	4.1	4.9	7.7	4.6
7.	10.0	7.1	24.0	24.0	21.0	8.3	9.9	11.0	17.8
8.	12.0	29.0	7.4	4.5	8.4	21.0	17.0	13.0	5.3
9.	5.0	7.0	4.1	5.3	4.5	5.6	8.2	16.0	5.6
10.	5.9	5.1	3.5	1.4	4.1	7.9	5.8	11.0	5.2
11.	1.2	1.0	7.0	8.3	6.6	3.1	1.7	2.1	--
12.	5.5	6.0	2.2	2.8	2.8	5.0	5.4	1.6	3.5
13.	5.3	4.3	2.2	2.2	4.1	5.2	5.2	3.3	4.9
14.	.25	.20	--	.59	--	.42	.22	1.1	--
15.	.10	--	2.6	--	3.5	--	.59	.17	--
16.	4.4	.35	4.1	--	4.7	5.9	5.0	3.5	2.0
17.	7.3	8.3	12.4	2.5	12.0	12.0	9.8	11.0	--
18.	20.0	8.6	4.9	3.3	2.2	16.0	14.0	.94	--

References for Incidence of Disease or Indications of Educational Want or Need

1. National Disease and Therapeutic Index: Leading Diagnoses and Reasons for Patient Visits, July 1967 - June 1968, Number 31.

   A panel of over 1,500 randomly selected physicians' reports on all private patient contacts occurring during a 48-hour period once each quarter of a year.

2. Avney, Helen Hershfield, Physician Service Patterns and Illness Rates: A Research Report on Medical Data Retrieved from Insurance Records, 1967, p. 267.

   Group Health Insurance, Inc. report giving percent of diagnoses involving 50,529 GHI members in New York and New Jersey in 1964.

3. Wisconsin Medical Dial Access Library Reports (unpublished).

   9,273 tape requests by Wisconsin physicians from January 1968 through June 1969.

4. Northlands Regional Medical Dial Access Library Reports (unpublished).
   2,772 tape requests by Minnesota physicians from September 1968 through May 1969.

5. North Dakota Regional Medical Dial Access Library Reports (unpublished).
   869 tape requests by North Dakota physicians from September 1968 through June 1969.

6. Peterson, O. L., et al., An Analytical Study of North Carolina General Practice, Journal of Medical Education, 31:139 (Dec) 1965, Appendix V., p. 162-165.

   Data involves 15,419 patient visits to North Carolina general practitioners during the study period.

7. Chute, Kenneth F., The General Practitioner: A Study of Medical Education and Practice in Ontario and Nova Scotia, University of Toronto Press, 1963, Appendix A.

   Data involves 10,607 patient visits to general practitioners in Ontario and Nova Scotia during the study period.

8. PAS Reporter, (Newsletter), Commission on Professional and Hospital Activities, Ann Arbor, Michigan, Vol. 7, No. 2, July 21, 1969.

   Data involves discharges of 6.1 million patients from 1,118 participating hospitals during 1967, giving the 50 most common final diagnoses.

9. Collen, Morris F., Presymptomatic Detection and Early Diagnosis: A Critical Appraisal, C.L.M.H. Sharp, Baltimore, Maryland, 1968, p. 64-65.

   Rate of disease per 100 patients for 9,760 patients seen by the Permanente Medical Group, Oakland, California, during 1965.

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